

# Financialization, Quantism and Carbon Markets: Variations on Polanyian Themes

‘We built a system that was much more dangerous than anyone thought.’

Simon Johnson, former IMF Chief Economist, November 2008<sup>1</sup>

‘What, exactly, are we trading in?’

*Environmental Data Services Report*, July 2004<sup>2</sup>

Quick to link the 2007-08 financial crisis with concurrent crises of climate, food, energy, health care and militarism, and hailing the apparent breakdown of the neoliberal experiment, progressive groups worldwide have recently been calling for the building of integrated popular movements for greater ‘democratic control over financial and economic institutions.’<sup>3</sup> ‘The financial crisis of 2008 presents the best opportunity in over a century to simultaneously reform money systems and create additional mediums of exchange and financing mechanisms to accelerate the shift from the fossil-fuel/nuclear-Industrial Era to the greener information-rich Solar Age,’<sup>4</sup> goes one manifesto. ‘[T]he current situation of crisis is also an opportunity,’ insists another, proposing ‘food sovereignty’ as slogan under which to agitate against deregulation and the ‘ferocious offensive of capital and of transnational corporations to take over land and natural assets’ and to speculate in food futures contracts.<sup>5</sup> ‘The two crises of our times — economic recession and global warming — should be tackled together,’ urges yet another. ‘The trillions of dollars earmarked for economic recovery can be spent to fight climate change.’<sup>6</sup>

Progressives, of course, are not the only ones being spurred by current crises to reorganize. Despite having been caught off guard by financial meltdown, governments and business elites are pressing forward with a bewildering variety of their own responses. Banks are being bailed out or nationalized, interest rates cut to near zero, ratings agency reforms promoted, and programmes formulated to rewrite the rules of global finance. Plans are being discussed to institute ‘a new national Keynesianism along Sarkozy lines,’ invest in vast tracts of land in the global South, and tackle global warming and economic reversals simultaneously through ‘Green New Deals’<sup>7</sup> or investments in geoengineering, agrofuels and synthetic biology. In the meantime, schemes for further financial deregulation roll on under the General Agreement on Trade in Services (GATS) of the World Trade Organization (WTO).

Somewhere near the centre of this confused post-meltdown global landscape lie the carbon markets set up under the Kyoto Protocol, the European Union Emissions Trading Scheme (EU ETS), the Chicago Climate Exchange and many other initiatives. Although they form part of a 35-year-old pattern of neoliberalism and financialization that is now being called into deep question, carbon markets remain the dominant official response to climate change worldwide. After roughly doubling

in size each year from 2005 through 2008, they are set for a further explosive expansion in the US under the administration of Barack Obama, as elsewhere. While carbon markets' current volume of over US\$100 billion<sup>8</sup> cannot yet compare to the half-quadrillion dollar-plus nominal value that the overall financial derivatives markets reached in 2007, carbon trading is being heralded as the 'world's biggest commodity market' and prospectively 'the world's biggest market overall,'<sup>9</sup> with 'volumes comparable to credit derivatives inside of a decade.'<sup>10</sup> As a welcome new 'asset class' with a low correlation to both the S&P 500 and the Dow Jones-AIG Commodity Index, carbon has proved a magnet for hedge funds, energy traders, private equity funds and large global investment banks such as Barclays, Citigroup, Goldman Sachs, BNP Paribas and Merrill Lynch as well as index providers and European exchange-traded commodity sponsors,<sup>11</sup> being widely seen as one risky but intriguing opportunity for profit-taking amid the chaos that has engulfed much of the rest of the financial world. Significantly, the largest carbon markets are those created and maintained by government regulation and supported by a consensus of the middle-class environmentalist movement in industrialized countries (which tends to see them as 'better than doing nothing about climate' or 'the only show in town') as well as, more recently, by many ruling elites in the South. Carbon markets' nature and their links to financialization, however, are still little discussed among social movements and intellectuals preoccupied with more traditional terrains of corporate control, privatization, trade, globalization, inequality and so forth, and have not normally been placed by political economists in the same analytical basket as other issues concerning power, ownership and redistribution.

Carbon markets thus pose a challenge to progressive movements seeking a common response to financial crisis and to official failures to address climate change. This article suggests concrete ways of holding both within the same strategic vision by proposing parallels between the rampant financial innovations that have contributed to the current crisis and the innovations feeding carbon trading. Relying on groundwork laid by Marx and Polanyi, it also calls on recent advances in the social studies of finance as well as the insights of both financial and carbon market practitioners and grassroots communities on the receiving end of the new trade arrangements.

The first section will set out a broadly Polanyian framework for situating the new finance, suggesting that the enormous growth in the derivatives market since the 1970s constitutes a wave of marketization of certainty/uncertainty that has entailed a new 'double movement' involving both commodification and attempts at societal self-defence.<sup>12</sup> New commensuration practices transforming what Polanyi might refer to as this 'fictitious commodity' into a target for investment, developed by 'quants', regulators and financial institutions, have both nurtured and been nurtured by the financial explosion. A second, central section will review some of the basics of carbon markets and explore parallels with the new financial markets. These include, among others, 'decoupling' from underliers; the role of 'quantism' in commodity creation, profit and capital accumulation; historical dynamics resulting from contradictions, 'overflows' and movements toward societal self-protection; vulnerability to bubbles and crashes; ownership and redistribution; knowledge destruction; the erosion of notions of transparency and conflict of interest; and the nature and role of regulation. A final section will briefly draw some strategic conclusions.

## Financialization

While disagreements are rife about the nature, novelty, importance, drivers and consequences of financialization, as well as about its relationship to accumulation, globalization and neoliberalism,<sup>13</sup> there is little dispute that an increasing role has been played by ‘financial motives, financial markets, financial actors and financial institutions in the operation of the domestic and international economies’<sup>14</sup> since the decline of the Bretton Woods system in the mid-1970s, and that finance has now ‘penetrated across all commercial relations to an unprecedented direct extent’<sup>15</sup> and ‘permeates everyday life’<sup>16</sup> as never before. By the late 1990s, finance, insurance and real estate had come to account for a greater share of US corporate profits than either manufacturing or services,<sup>17</sup> and by 2007 the profits of US financial companies stood at 41 per cent of total corporate profits, after tax, compared with less than 5 per cent in 1982.<sup>18</sup> As profits from non-financial activities have declined, even the most venerable non-financial companies have opened financial divisions. By 2003, for instance, 42 per cent of General Electric’s profits were generated by its GE Capital division, and by 2004 80 per cent of General Motors’ income came from the GM Acceptance Corporation.<sup>19</sup> Facing dwindling returns from investment in industry and losing big customers to other credit suppliers, banks have meanwhile increasingly learned to rely on non-interest income. Non-interest income as a proportion of bank profits rose in the US from 25 per cent in 1980 to 41 per cent in 2005, in Spain from 15 to 33, in Germany from 20 to 34, and in France from 23 per cent in 1990 to 62 per cent in 2005.<sup>20</sup> Meanwhile, hedge funds increased in number from 3,000 in 1996 to 8,900 in 2006, with their assets growing more than 10 times.<sup>21</sup>

Crucial to financialization, and the ability of proliferating financial institutions to create opportunities for the absorption of cheap, mobile surplus capital from pension funds, mutual funds, private equity funds, insurers, hedge funds, sovereign wealth funds and elsewhere, has been an ‘arms race’ in the development of new financial technologies ranging from information, communication and computing technologies to pricing models. Markets in innovative derivatives including futures and options on interest rates, currencies and commodities, credit default swaps and so on expanded from virtually zero in the 1970s to nearly \$100 trillion in 2000 and \$680 trillion in 2008.<sup>22</sup> (The actual value these derivatives would bring if sold today, rather than their theoretical value when trades come due in the future, is much less, but still estimated as approximately equivalent to the entire economic output of the United States.)<sup>23</sup> Whereas in the 1970s, most currency exchanges went to finance international purchases of goods and services, today the figure is less than 0.1 per cent;<sup>24</sup> the rest is essentially gambling. Securitized debt facilitated vastly increased lending, with a big shift toward individual consumption and mortgage loans, together with huge leverage ratios. The annual value of securitization issues increased more than five times in the decade to 2006 in the US, Europe, Australia and Japan. Profligate mortgage lending in the US in particular contributed to a pre-existing housing bubble and then a global credit crisis, damaging the livelihoods of millions.<sup>25</sup> Speculation on food has meanwhile led to increased hunger worldwide.

For this article’s purposes, an appropriate place to begin to contextualize such developments will be with Polanyi’s concept of the ‘fictitious commodities’ of land, labour and money, whose ‘framing’ as commodities (to borrow Michel Callon’s<sup>26</sup>

term) leads to ‘overflows’ and a dynamic of resistance, retrenchment and more or less fumbling attempts at societal self-defense that Polanyi called the ‘double movement’. Polanyi famously remarked that the commodification of land was among the ‘weirdest undertakings of our ancestors.’ Any mechanism that in the extreme case could result in any land being bought and accumulated in any amount by anybody with enough cash, and then used for any purpose and exchanged for anything with anybody in any amount, obviously had certain built-in tendencies to destroy knowledge and the institutions of stewardship ensuring sustainable food, shelter and other necessities of survival. Not only local food supplies but also the preservation of soils and forests depend on people not constantly exchanging their lands for other lands, or the land constantly exchanging its peoples for other peoples, or for none. To make the use of land fully dependent on the market mechanism would be ‘to subordinate the substance of society itself to the laws of the market,’ with fatal results.<sup>27</sup>

Similarly for security and danger, certainty and uncertainty. ‘Derivatives are commodified risk.’<sup>28</sup> Price-uncertainty-as-commodity is separated from its underlying asset and from the political aspects of commerce, repackaged, made commensurable with new things, mathematized and sent through new circuits. ‘Risks became “things” like commodities – tradeable at any moment at the right price.’<sup>29</sup> Investors can buy exposure to movements in the value of oil cheaply without having to lay out any money for oil themselves, movements in the value of a company without trading shares in the company themselves. So instead of stockpiling a million barrels of oil in anticipation of a shortage, speculators can buy an oil derivative that gives exposure to the price movement on 25 million barrels. They get leverage and can hedge and speculate more cheaply. Increased leverage then tends both to make bubbles bigger and to deepen crashes when calls are made on reserve capital. It also encourages instability by turning classroom theories of equilibrium upside down:

‘When there is no leverage in the system, ... a higher price triggers selling and a lower price triggers buying. When there is enough leverage in the system then the reverse is true: higher prices trigger buying, to close losing positions; lower prices trigger selling. ... The unwinding of ... losing positions exacerbates the price action, triggering yet more stop-losses.’<sup>30</sup>

Once Polanyi’s category of ‘fictitious commodities’ is extended to include also not only work and money, but also uncertainty and security, his remarks about land, sometimes seen as *sui generis*, can be seen to be of a piece with earlier insights into finance from early 20<sup>th</sup>-century liberal collectivists. Writing in the 1920s, Tawney cautioned against practices of ‘passive ownership’ that are ‘normally divorced’ from use, ‘creative activity’, or even ‘efficient production’, and under which ‘there is no guarantee that gain bears any relation to service, or power to responsibility.’ He went on to note the dangerous novelty of the transferable share, which, he complained, had been ‘stripped of almost all the encumbrances by which property often used to be accompanied.’<sup>31</sup> A decade and a half later, Keynes reminded his readers that when ‘[i]nvestments which are ‘fixed’ for the community are ... made ‘liquid’ for the individual’, the result may be destruction of knowledge of the business in question and its value:

‘Of the maxims of orthodox finance none, surely, is more anti-social than the fetish of liquidity, the doctrine that it is a positive virtue on the part of investment institutions to concentrate their resources on the holding of ‘liquid’ securities . . . there is no such thing as liquidity of investment for the community as a whole.’<sup>32</sup>

More important for the purposes of this article are parallel observations being made about what is euphemistically called ‘financial innovation’ by market practitioners of our own time. Writing more than 60 years after Polanyi, hedge fund trader Richard Bookstaber deploys an argument about financial crashes that could be a further extension of Polanyi’s warnings about the limits of attempts to commodify ‘fictitious commodities’:

‘Just because you can turn some cash flow into a tradable asset doesn’t mean you should . . . [I]n the efficient market paradigm . . . nirvana is attained when a position can be taken against every possible state of nature. But in the world of normal accidents and primal risk, limitless trading possibilities might cause more harm than good [that] cannot be easily disarmed through oversight or regulation . . . these innovations have externalities for the entire financial system that are hard to measure but dominate their apparent value.’<sup>33</sup>

In the same vein, J. P. Bouchaud of Capital Fund Management notes that models used to price structured financial products that packaged sub-prime mortgage risk into seemingly respectable high-yield investments ‘neglected the very possibility of a global crisis, even as they contributed to triggering one’ since they ‘underestimated the probability of that multiple borrowers would default on their loans simultaneously. . . financial engineers who developed these models did not even realize that they helped the credit mongers of the financial industry to smuggle their products worldwide.’<sup>34</sup>

Yet what is it about the ‘commodified thinking’ about uncertainty characteristic of the current era of financialization (to adopt the phrase of options trader Nassim Taleb)<sup>35</sup> that sets it apart from more conventional market practices regarding uncertainty that do not threaten the social fabric in the same way? Insurance, for example, is sometimes cited as a benign precedent for many of today’s financial inventions such as interest rate options. Buyers of insurance, somewhat like derivatives traders, pay a price of a price<sup>36</sup> – that is, the price of keeping the price of what they own above a certain level. Insurance companies provide the requisite liquidity, taking the other side of the transaction by betting, for example, that customers don’t die or their houses burn down over the next 10 years. However, they typically do so only on condition that, there are calculable, independent probabilities attached to any possible outcome and that the companies will be able to cooperate with the state in deploying enforcement that ensures that flesh-and-blood insurance buyers approximate the idealized ‘nongaming’ or ‘nonreflexive’ subject of actuarial tables, whose reticence to kill themselves or burn down their own houses is unaffected by the act of insuring itself. Insurance companies, in other words, have historically tried to operate within a carefully-manicured arena in which uncertainty (restricted as closely as possible to probabilistic risk, in this case) can be made market-friendly without necessarily endangering overall social welfare.<sup>37</sup> The new derivatives markets, by contrast, operate across a much wider field of unknowns when wagering on changes in the cost of money or commodities, currency relationships and so forth, relying on the

‘mystification of uncertainty or contingency as if it were measurable as probability.’<sup>38</sup> This has systemic dangers, especially when rare or unforeseeable events occur that have massive impact. What Frank Knight dichotomized in the 1920s as risk and uncertainty<sup>39</sup> tend to be conflated, ‘looping’ phenomena confused with non-looping, and ‘fat tails’ run together with the ‘thin tails’ characteristic of the bell curves of the world of everyday insurance. In addition, the uncertainties commodified by the new derivatives markets are not the independent probabilities to which traditional insurance attempts to restrict itself. Thus, as financial journalist Matthew Philips writes, the ‘fatal flaw’ of the insurer American International Group, which had begun in the 1990s to insure not only houses but also the mortgages on those houses by issuing derivatives, ‘appears to have been applying traditional insurance methods to the credit default swap market’:

‘There is no correlation between traditional insurance events; if your neighbor gets into a car wreck, it doesn’t necessarily increase your risk of getting into one. But with bonds, it’s a different story: when one defaults, it starts a chain reaction that increases the risk of others going bust. Investors get skittish, worrying that the issues plaguing one big player will affect another. So they start to bail, the markets freak out and lenders pull back credit.’<sup>40</sup>

Such ‘systemic risk built up steadily in the system,’ adds economist Michael Spence, and ‘was either unnoticed or was not acted upon. ... Financial innovation, intended to redistribute and reduce risk, appears mainly to have hidden it from view.’<sup>41</sup>

This is not to suggest that the need to insure against uncertainty was not a crucial motivation for the new instruments. As Edward LiPuma and Benjamin Lee stress, the ‘proliferation and institutionalization of contractual outsourcing’ associated with the wave of globalization that began in the early 1970s ‘increased existing risks, such as counterparty and interest rate risks, even as it spawned new ones, such as currency and sociopolitical risks’ that ‘could not be handled or offset by the conventional forms of insurance (such as hedging)’:

‘For many corporations doing business globally, the problematic and uncontrollable consequence of outsourcing was that exogenous events beyond their control or corporate intelligence, such as a steep shift in cross-currency rates due to the election of a socialist-leaning president, could seriously harm or destroy the profitability of an enterprise.’<sup>42</sup>

The withdrawal of industrialized-country states from the task of ‘securing the present to the future’<sup>43</sup> using fixed exchange rates, stable interest rates, commodity price stabilization and the like, after the early 1970s, had some of the same effects. In a broadly similar way, energy privatization and re-regulation in the US added to weather-related risks for power utilities when they found themselves having to cope with new uncertainties about demand volumes as well as about fluctuation in prices and margins.<sup>44</sup> And so on. Derivatives, whether interest rate options, weather derivatives or other instruments, did respond to such problems with seemingly insurance-like solutions. But for derivatives to work,

‘their markets needed to be liquid, the principals able to purchase and sell securities as their needs demanded. The need for liquidity provided a new avenue and opportunity

for absorbing the over-accumulation of capital of the metropole, giving birth to institutions ... that specialized in managing what ‘the street’ would call ‘speculative capital’.<sup>45</sup>

The ability of the new setup to absorb surpluses meant that it ‘quickly took on a life and evolutionary trajectory of its own’:

‘... derivatives unify in a single instrument the objectification of various types of risk, the almost extraordinary leveraging of those risks, and the possibility of being used for both hedging and speculation. ... the speculative use of derivatives increases both the quantity and velocity of capital ... [in] a treadmill-like effect ... corporations doing business transnationally employ derivatives to offset ... volatility; the provision of sufficient market liquidity requires the participation of speculative capital which tends to amplify volatility; the amplification of volatility both increases the need ... to hedge ... and the profit opportunities for speculatively driven capital.’<sup>46</sup>

This is another reason for questioning the common mythology that the prototypes for the new finance are the relatively simple hedges used by 17<sup>th</sup>-century Japanese rice farmers,<sup>47</sup> 13<sup>th</sup>-century monks,<sup>48</sup> 16<sup>th</sup>-century Dutch herring fishers<sup>49</sup> or 20<sup>th</sup>-century Iowa corn farmers<sup>50</sup> to insure against losses due to price drops at harvest time. Today’s derivatives are used far more for global speculation and leverage than for anything that might be called insurance.<sup>51</sup> Indeed, they tend to make the one the condition for the other, functioning less to achieve the safety-first ‘peasant goal’ of minimizing the risk of losing money through a declining exogenous market (nor, for that matter, to serve what is sometimes called the ‘real’ economy) than to provide liquidity for market expansion and to allow a peculiarly unrestricted form of gambling on price fluctuations and market manipulation. That function lies at the other end of the prudential spectrum entirely, a fact particularly obvious when speculation’s role in creating asset price bubbles and crashes is considered. If bets go wrong, derivatives traders and those who have become dependent on them, unlike prudential farmers, stand to lose everything unless they undertake other transactions that offset the risk – which involves further gambles.

What distinguishes the gambling inherent in contemporary derivative trading, moreover, is the degree to which it has been shaped by becoming ‘disembedded’ from one context only to be ‘re-embedded’ (in a Callonian sense) in another.<sup>52</sup> One way of illustrating the change is to compare, on the one hand, the gamble taken by the bank managers of yesteryear on modest mortgages of local residents of their acquaintance with, on the other, the gamble taken today by, say, Norwegian municipal investors on tens of millions of dollars of doubly-repackaged collateralized debt obligations built on Detroit and Memphis mortgages, priced by mathematical models, and assembled through software routines executed in London. Another way of illustrating the change is to compare a casino to the global arena of gambling that derivatives have helped open up. Commentators sometimes imagine it to be a damning criticism to accuse the financial markets of having turned the economy into a casino. But in some senses that is an insult to casinos. A casino, like a traditional insurance company, attempts, insofar as it can do so, to operate in an artificially-landscaped, highly-constrained environment. It emphasizes games (roulette, slots, cards) whose odds can be calculated, places limits on amounts, deploys state-of-the-art surveillance technology, and generally does its best to ensure that, in the long term, the house always wins

(which can mean banning bettors who can calculate better than the house can).<sup>53</sup> In addition, casinos, like traditional gambling generally, are hemmed in by legal, geographical and moral restrictions aimed as much as possible at preventing households (or nations) from gambling their lives away. While any sort of betting, large or small, commodifies certainty/uncertainty, the more disreputable forms of traditional gambling have typically been subject to various legal, moral and prudential restrictions – parallel to those that operate to various degrees throughout the world to condition the commodification of land, food, labour and other ‘fictitious commodities’ – in a way that partially shields households, livelihoods and nations from catastrophe. Financial derivatives, by contrast, in the course of commensurating insurance, gambling, saving and lending, disembed them from their former contexts and re-embed them in neoclassical economic theory, neoliberal policy, portfolio and pricing theory, and private financial institutions. Part of this process involves embedding derivatives gambling in economic ‘risk management’ methodologies. But being ‘performed’<sup>54</sup> by technologies to measure ‘Value at Risk’ can create its own dangers when the control system is fed unexpected bad news.<sup>55</sup> Hedging one person’s investment means exposing another (and the system as a whole) to potentially catastrophic bets of whose nature he or she may not be aware. Gambling is transplanted into a far less tame, predictable and controlled environment at the same time it paradoxically gains legal and moral sanction.

Indeed, removing traditional stigmata has been as crucial to commensuration in modern finance as it was to the commensuration required for, say, the emergence of significant global food prices several centuries ago. This legal and moral disentanglement took a great deal of hard political work to achieve, although that work was not necessarily always carried out in full awareness of the eventual outcome. In Britain, options were banned, as a form of gambling, in the 18<sup>th</sup> and 19<sup>th</sup> centuries, and also in France from 1806 and in many US states in the 19<sup>th</sup> century.<sup>56</sup> In the US, until the late 1970s, derivatives trading was considered gambling unless (as in the case of futures and forwards) ‘a futures contract could be settled by physical delivery of the underlying commodity, for example grain.’<sup>57</sup> Investors were not allowed to buy securities entirely on credit and short-selling was constrained by law.<sup>58</sup> It was only later that a narrative was built up according to which speculating in derivatives would be not gambling but rather a natural outgrowth of an endogenous demand for liquidity and ‘efficiency’. Early US derivative *bricoleur* Leo Melamed, a Chicago trader, went so far as to pay Milton Friedman \$5,000 to write a paper supporting a currency futures market that he could then use in lobbying Washington to give the green light to his project of setting up a new Exchange.<sup>59</sup> The Chicago Board of Trade had to hire still other economists to come up with a ‘public interest’ case for introducing options<sup>60</sup> for use in lobbying the Securities and Exchange Commission (SEC).<sup>61</sup> According to one knowledgeable observer, it was the Black-Scholes option pricing equation – a Nobel prize-winning ‘quant’ invention discussed below – that really got the new Chicago Board of Trade’s Options Exchange off the ground:

‘[Black-Scholes] gave a lot of legitimacy to the whole notion of hedging and efficient pricing, whereas we were faced in the late 60s-early 70s with the issue of gambling. That issue fell away, and I think Black-Scholes made it fall away. It wasn’t speculation or gambling, it was efficient pricing. ... I never heard the word ‘gambling’ again in relation to stock options traded on the ... Exchange.’<sup>62</sup>

Helping further to disembed financial gambling from previous social controls – and re-embed it in economic theory and neoliberally-inclined institutions operating globally – were such phenomena as the erosion and 1999 repeal of the Glass-Steagall Act in the US, which had been passed four years after the Great Crash of 1929, and the privatisation of building societies in the UK. Partly motivated by the need to counter London's efforts to poach financial business from New York by offering a less-regulated environment, the repeal of Glass-Steagall enabled commercial banks to use their deposits as collateral for globalized gambling, commensurating them with the wall of money being created and augmented by the growing 'shadow banking system' of the new finance and blurring the distinction between investment banks, commercial banks and insurance companies. To stay competitive, investment banks – many of which had eagerly purchased various mortgage companies – had to create 'a lot of additional risk to make a lot of money on the back of nothing – that is, borrowed or leveraged money – because they didn't have deposits.'<sup>63</sup> Pooling, recombining and concealing assets bearing different kinds of risk and uncertainty, further commensurating them with various 'hedge' investments, blurring different credit lines, and setting up special-purpose vehicles all also helped the disembedding process. So did the regulatory decision to allow banks to take securitized loans (used to raise finance to make more loans) off their balance sheets. As Dick Bryan and Michael Rafferty note, derivatives, because they are separated from ownership of the underlying assets, are able to 'blend' attributes of multiple asset forms in a new way as relations are established between present and future prices. Convertible bonds, for example, break down the distinction between debt and equity just as portfolio theory helped commensurate risk and profit. 'Each derivative product is a package of conversion of one form of capital to another,' invoking

'a huge market process in which all different forms (and temporalities) of capital are priced against (commensurated with) each other. By this process of commensuration, rates of return on different assets can be directly measured and, in a competitive capitalist environment, there follows a requirement of each asset, across space and time, to deliver a competitive return.'<sup>64</sup>

Today it is difficult even to define a hedge fund or distinguish between 'traditional' and 'alternative' investment management,<sup>65</sup> with sobering implications for any conventional attempt to regulate finance.

The landscape shifted as well as businesses and governments were commensurated into a single class of economic actors engaged in a unified effort to deliver returns, 'agents subject to the same structures of opportunity and decision.'<sup>66</sup> 'Chinese walls' between research and banking at investment firms were also breached: 'What used to be a conflict [of interest] is now a synergy,' was the famous judgement of Jack Grubman of Salomon Smith Barney as early as 2000.<sup>67</sup> The growing complexity and obscurity of financial technologies gave regulators yet another reason for taking the easy choice and opting for what Alan Greenspan euphemistically referred to in recent Congressional testimony as 'private regulation.' According to lawyer Frank Partnoy, instead of ruling whether or not financial companies should be allowed to buy and sell certain securities, regulators began deferring as early as the 1970s to credit-rating agencies such as Moody's, Standard & Poor's and Fitch, by passing regulations that depended on ratings. Unsurprisingly, the agencies' fees, which came from the

companies whose offerings were being rated, mushroomed, resulting in nicely commensurate AAA ratings for billions of dollars of stupendously dubious and heterogeneous securities.<sup>68</sup> The concept of conflict of interest slipped into obsolescence at the highest levels of government as well. Although officials such as the US Secretary of the Treasury had always been likely to come from, and return to, Wall Street, it became less and less acceptable to raise questions about conflicts of interest among the new generation of top appointees such as Robert Rubin, Hank Paulson, Dick Cheney and Paul O'Neill, all of whom came from derivatives-trading institutions and were fiercely anti-regulation. What regulatory energies existed were often diverted into laments about punters' supposed financial illiteracy. By the late 1990s, bringing the over-the-counter derivative market under any official oversight at all was considered out of the question. Just as Bill Clinton was about to leave the White House, Congress passed the Commodity Futures Modernization Act, which both exempted derivatives from oversight under state gaming laws as well as from reserve requirements and excluded certain swaps from being considered a security under SEC rules. Nor did regulation keep up when mortgage banks and brokers, a few years later, began to dominate the primary mortgage market, and there was little official monitoring of the swelling housing bubble. Internationally, the WTO, which was a factor in the revocation of Glass-Steagall, continues to mandate deregulation of all derivatives except, oddly, onion futures, and remains an obstacle to tackling the credit crisis worldwide.

All these trends interpenetrated with, and both nurtured and were nurtured by, what might be called *quantism*. If there are now such things as 'financial products,' as the titles of the relevant divisions of many corporations suggest (the terms 'financial product' and 'financial service' appear to have become widespread in the 1990s), then quantism can be considered the relevant mode of 'production'. In the case of financialization, quantism is the material and social process of isolating, laying claim to, objectifying, simplifying, abstracting, quantifying, commensurating, pricing and aggregating masses of unknowns by which derivatives are manufactured and financial uncertainty commodified. Computers and high-end mathematical talent are used in greatly expanded efforts to break down, reframe, mathematize, diversify across, appropriate and charge rent for the future. As property and consumer bubbles expand, financial profits stream in from, among other things, what Robin Blackburn calls 'the cancellation of promises made to employees ... the erosion of small capital holdings by large and unscrupulous money managers and the swallowing of shoals of tiny fish by a shark-like financial services industry.'<sup>69</sup>

Although it is exemplified by such inventions as modern portfolio theory, the capital asset pricing model and the Black-Scholes pricing model, quantism is not a disembodied collection of advanced mathematics arriving from the ether with a few supercomputers attached – an unfortunately obscure, but nonetheless 'objective' advance in risk calculation facilitating advances in the efficiency of capital and the accrual of 'shareholder value', which is then seized upon and 'applied' (or misapplied) by canny or self-interested practitioners. The history and suspicious shortcomings of the calculations themselves – pointed out by brainy, experienced derivatives traders such as Richard Bookstaber, Nassim Taleb, Satyajit Das, George Soros and J. P. Bouchaud – quickly put paid to that view. Although, unlike Keynes, another practitioner-critic of finance, these traders concern themselves rather more with 'blowups' and market crashes than with power, property or distribution, they

have all found themselves in recent years restlessly circling the subject of the blocks to what Polanyi might have called the complete commodification of uncertainty and security. Bouchaud, for instance, has berated the ‘incorrect axioms’ of financial theory, including Black-Scholes’ assumption that price changes have a Gaussian distribution, which, he says, itself destabilized the market: ‘there is no framework in classical economics to understand wild markets, even though their existence is so obvious to the layman.’<sup>70</sup> Along similar lines, Taleb has pointed out that ‘Value at Risk’ methodologies, and ‘risk management’ generally, have slighted the problem of ‘black swans’ (unforeseeable events of high impact resistant to commensuration and conventional financial calculation, although not to other modes of social thinking) to the extent that they should be simply scrapped.<sup>71</sup> Das has followed up with satires on the logic that drives risk management toward the status of ‘pure entertainment.’<sup>72</sup> Soros has laid a Keynesian stress on the psychology of investment markets, arguing that positivistic risk management models ignore ‘uncertainties inherent in reflexivity’ or positive feedback effects of investor bias that keep markets away from equilibrium, contradicting the efficient markets hypothesis.<sup>73</sup> Bookstaber has pointed out that the unlimited commensurability, tight coupling and interactive complexity brought about by the new financial engineering can be self-defeating in a way that regulation does not necessarily have any power to restrain and may even exacerbate.<sup>74</sup>

Yet what these trader-critics point to are not, *pace* Bouchaud, ‘mistakes’. Quantism is not a set of disembodied theories dreamed up by detached academics who ought to be forced into a rethink now that they have been roundly defeated by a messy, wicked reality. Black-Scholes ‘worked’, and even apparently helped shape prices, ‘performing’ the market, up to the point of the 1987 crash. Fischer Black himself was well aware of ‘The Holes in Black-Scholes’<sup>75</sup> (as well as the limitations of ‘value at risk’ methodology) and pointed out ways traders could exploit them, but remained faithful to the abstract creed that ‘the market’ was the ‘best agent of collective human reason’.<sup>76</sup> One analogy is with Fordist processes of ‘framing’ large tracts of land for maximum short-term commercial production of uniform timber or pulpwood, including surveying the land and marking examples of desirable species, estimating return per hectare of various varieties, thinning and eliminating ‘extraneous’ biodiversity and human habitation, and finally planting serried, factory-friendly monocrops of species, clones and, ultimately, trees engineered to be genetically identical.<sup>77</sup> State and market actors working through such processes do understand that they are drastically simplifying the landscape both in ‘theory’ and in ‘reality’. They may not be fully aware of possible systemic ‘blowups’ in the long-term, such as soil depletion, pest infestations, disease, genetic erosion, farmer revolt and fire,<sup>78</sup> but for them the overall process is reasonable.

Warts or not, moreover, the Black-Scholes equation cannot be cast as any kind of mathematical hero-agent. Although Black-Scholes calculators were being marketed within six months of the publication of the original paper, and its variants and descendants are still being programmed into Wall Street computers, it is often used by people with a limited understanding of the mathematics. More importantly, in some ways it may be merely a label for more vernacular option-trading ‘heuristics and tricks’ – some with a century-old pedigree – that in fact disregard some of the key assumptions of the equation.<sup>79</sup> It is likely also to have served partly as a political coordination and public relations device that helped cement the position of the academically-trained faction of the Wall Street high salariat and preserved the

theory/practice distinction so important to modern forms of power.<sup>80</sup> If Black-Scholes advanced the cause of new types of commensuration, it did so at no more basic or metaphysical a level than did, say, de-regulation and re-regulation of banking, the scamming of rogue traders, or the quotidian collation of statistics about hours of sunshine or centimetres of rainfall that is used to create quantified weather indexes.

Whatever contradictions confront quantism, in short, *pace* some of the trader-critics, do not arise from ‘theoretical’ problems or oversights. It would be more exact to say that they ‘go all the way down’ into the equations and axioms of the new financial theories because they are deeply-rooted at all levels of the phenomenon. The politics inside the mathematics, which poses and responds to questions which are interested as well as interesting, admitting certain enquiries and qualifications but not others, are one with those of the institutions, devices and networks with which it is entangled, which centre on financial districts and universities but extend throughout the world.

By the same token, it would be misleading to brush aside quantism’s distinctive contradictions as if they merely added a bit of froth to the surface of the ‘same old same old’ currents of financial capitalism and neoliberalism, featuring overproduction, business cycles, manias and crashes, poor management, greed, Ponzi impulses, ineffective regulation and the like, all of which should be the real target of criticism. To be sure, the new financial techniques, through their obscurity, complexity and resistance to public oversight, reinforce pre-existing structures of exploitation. The gains they enable, in fine traditional style, are disproportionately reaped by financial intermediaries with access to high technology and inside information. They redistribute risks, just as traditional neoliberal policies did. When liquid markets are absent, they often read prices off models, just as traditional cost-benefit thinking does.<sup>81</sup> But they are also a transformative force, having ‘increased the risk of economic fluctuations and downturn and created new uncertainties’<sup>82</sup> and new processes of dispossession, responding to volatility only by increasing it, supplying liquidity and leverage only at the cost of turbulence. And they create new subjects free to pursue a particularly extreme pattern of abstraction, distancing, mystification, commensuration by fiat and what Taleb calls ‘nerd knowledge,’ acquiring in the process some of that ‘ability not to have to learn’ that Karl Deutsch identified with power itself. Above all, they engender new overflows and resistances whose particularities cry out for more study.

### ***Carbon Trading***

The boom years of financialization coincided with the rise of carbon markets, which have become both the main official approach to the climate crisis worldwide and a potential rival to the financial derivatives markets in size. In 1997, the Clinton Administration successfully pressed for the Kyoto Protocol to become a set of trading instruments (Al Gore, who carried the US ultimatum to Kyoto, later became a carbon market actor himself), and in the 2000s Europe picked up the initiative to become the host of what is today the world’s largest carbon market, the EU Emissions Trading Scheme (EU ETS).

Closer to the shopfloor level, some of the same *bricoleurs* were present at the creation of both the new derivatives markets and the carbon markets. Richard Sandor, for example, is an economist and trader who was one of the originators of interest rate

derivatives in the 1970s, later making a fortune during the boom years of the 1980s at Drexel Burnham Lambert, the firm of the junk-bond innovator Michael Milken.<sup>83</sup> Sandor has also collaborated with Howard Sosin,<sup>84</sup> who subsequently helped set up and head the financial products division that ultimately laid the American International Group (AIG) low to the point of having to be bailed out by US taxpayers to the tune of \$152 billion.<sup>85</sup> Sandor has been named as an ‘environmental hero’ by *Time* magazine for helping to develop the idea of pollution trading in the 1980s and 1990s. In the 2000s, with philanthropic support, Sandor set up the Chicago Climate Exchange, which today commands a small but growing segment of the carbon markets. Other derivatives traders have also migrated to the ‘ecosystems services’ financial sector to manage funds and advise on the ‘measurement and monetization of land use carbon credits’<sup>86</sup> and so forth. Another indicative figure is Graham Cooper, who edited *Risk* magazine in the 1990s partly as a conference-for-profit operation serving the derivatives markets, soliciting articles from quants such as Fischer Black and Emanuel Derman. Cooper now plays the same role in the carbon markets as publisher of *Environmental Finance* and *Carbon Finance* magazines and organizer of industry events. Even more significant are individuals such as Ken Newcombe, a former executive at the World Bank, which is now introducing weather derivatives to countries such as Malawi. Newcombe helped set up the global carbon offset market at the Bank’s Prototype Carbon Fund beginning in the late 1990s, influencing UN regulatory decisions and helping put the Bank into a position to make money from attempts to compensate for the climatic damage caused by, among other things, fossil fuel-intensive developments it itself was underwriting in the global South.<sup>87</sup> As the market began to take off, Newcombe moved on to Climate Change Capital, a City of London boutique merchant bank, then headed up the North American carbon trading desk of Goldman Sachs before becoming CEO at the new carbon trading firm C-Quest Capital.

While some investors are still wary of the trade, many institutions active in derivatives are also staking out positions in carbon. Among the financial institutions that have set up desks to speculate in carbon permits are, in addition to Goldman Sachs, Deutsche Bank, Morgan Stanley, Barclays Capital, Fortis, Rabobank, BNP Paribas, Sumitomo, Kommunalkredit, Lehman Brothers, Merrill Lynch and Cantor Fitzgerald (see Tables 1 and 2 below). JP Morgan Chase has meanwhile snapped up the carbon offset firm Climate Care, while Credit Suisse has acquired a stake in the troubled carbon consultancy and accumulator EcoSecurities. As with derivatives, a host of specialized new institutions have also been set up that deal in the commodity, with names like Sindicatum Carbon Capital, NatSource Asset Management, New Carbon Finance, Carbon Capital Markets, Trading Emissions plc, South Pole Carbon Asset Management, Natixis Environnement & Infrastructures, Noble Carbon, ICECAP, and so forth. By 2008 there were about 80 carbon investment funds set up to finance offset projects or buy carbon credits, managing nearly \$13 billion; most are oriented more toward speculation than toward helping companies comply with regulated carbon caps.<sup>88</sup> Trading companies are also active, including Vitol, a major energy-market speculator; ENRON, too, was keen on the Kyoto carbon market before the firm’s spectacular collapse. In addition, industrial companies such as Arcelor Mittal have opened departments specifically to seek profits in the carbon trade, just as companies such as General Electric opened finance divisions in the 1990s.

As might be expected, there are also structural parallels between the new derivatives markets and the carbon markets. Indeed, the carbon commodity itself is commonly classed as a derivative. But carbon markets' unique characteristics also need to be emphasized.

Like derivatives markets generally, carbon markets isolate, objectify and construct a new product. But this product, although it can be conceptualised in different ways ('carbon' is something of a misnomer in this context), is different in many ways from the commodified price relationships, cash flows, and coupon uncertainties traded in derivatives markets. One way of characterizing the product is to say that it is a commodification of climate benefits/disbenefits, which must necessarily be constructed as discrete, divisible, quantifiable and commensurable. Governments then decide supply levels, rendering the commodity more or less economically scarce, and either sell it or, more usually, give it away to large industrial polluters. Trade in the commodity then supposedly makes climate change mitigation maximally efficient. Another way of conceptualising the product is to say that it is the result of the state enclosure, commodification and apportionment of the earth's carbon-cycling capacity, or ability to keep its climate stable.<sup>89</sup> Governments decide, whether on climatological or political grounds, how much of the world's physical, chemical and biological ability to regulate its own climate should be 'propertized' and privatised and then given away or sold at any particular moment, and to whom, before letting the market decide on its final distribution. Another way of conceiving of the commodity would be to say that it consists of universally fungible greenhouse gas pollution rights backed by an implicit government guarantee that an optimal 'climatically safe' amount of total rights in circulation can be, in principle, both specified and mandated.

## *Construction of a Climate Commodity*

Further "equivalents" are manufactured for additional cost savings and delays in addressing lock-in and added to the commodity pool in circulation (OFFSETS)



"Equivalent emissions" are pooled by abstracting from place, technology and history and then marketed (TRADE)



Goal is reconfigured as modest progressive state-mandated numerical greenhouse gas cuts (CAP)



**Contending with climate change: initiating new historical pathway to overcome fossil fuel lock-in or "addiction"**

Fig. 1

The overall process by which a commodity for the carbon markets is being assembled is summarized in Fig. 1. In the crucial first stage, climate crisis mitigation is translated into measurable, divisible greenhouse-gas ‘emissions reductions’. An individuated, tradeable commodity (a ‘thingified’ climate benefit/disbenefit) is created whose ‘efficient’ allocation in the form of pollution rights can become a coherent, apolitical programme for action (‘cap and trade’), and whose status as asset, grant, or financial instrument is engineered to fit various accounting standards.<sup>90</sup> A second class of divisible, measurable, thing-like climate-benefit units called ‘offsets’ is then developed to be pooled together with ‘reductions’, partly in order to enable wealthy industries and states further to delay reducing their own emissions, again in the cause of ‘efficiency’. These offsets are manufactured by special projects that are claimed to result in less greenhouse gases accumulating in the atmosphere than would be the case in the absence of carbon finance, such as tree plantations (which are supposed to absorb carbon dioxide emissions) or fuel switches, wind farms and hydroelectric dams (which are argued to reduce or displace fossil energy). In theory, ‘project-based’ credits, no matter what their origin, are to be fungible with the emissions allowances distributed in the North. Indeed, in a sort of commensuration-by-fiat, Articles 3 and 12 of the Kyoto Protocol stipulate, without argument, that these offset credits are *identical* with emissions reductions, thus legislating into existence a new, abstract, nonsituated, omnibus category of reductions/offsets. Despite the momentous scale and nature of this attempt at commensuration – the new abstract entity is analogous not only to the disembodied, aggregated category of ‘risk’ conjured up by the new financial markets, but also to the historically-specific social reality of abstract labour whose emergence Marx described – most governments and environmentalists have accepted it without question.<sup>91</sup>

The commensuration specifically connected with the ‘cap and trade’ component of this process is depicted in Fig. 2, and that associated with offsets in Fig. 4. The dynamic of framing and overflow, to borrow Callon’s terms again, follows a somewhat different pattern in each case, although the two dynamics share some of the same political and climatological implications. It will be useful to consider cap-and-trade and offsets one by one.

### *Cap and Trade*

To begin with cap and trade: the emissions ‘cap’, which does the ‘environmental’ work of cap and trade, is imposed by government regulation and is represented by the ovals of Fig. 2. One conventional way of achieving that cap is to dictate limits to how much each industrial installation covered by the scheme (represented by A and B) is allowed to pollute. If the overall cap on a sector’s emissions is 100 tonnes annually, for example, the government might require A and B to limit their emissions to 50 tonnes a year each. The ‘trade’ of cap and trade, however, promises to make achieving the overall cap cheaper for both A and B, and thus, so the theory goes, for society as a whole; this is the component that achieves the efficiency objective. Suppose, for example, that before the cap represented by either oval in Fig. 2 was imposed, A and B each produced 100 tonnes of pollution a year. Suppose further that it is expensive for A to reduce its emissions to 50 tonnes but cheap for B to do so. Suppose, in fact, that it is cheaper for B to reduce its emissions to zero than it is for A to reduce its emissions at all. In that case, the better economic choice is to allow B to

make A's reductions for A. Installation A can be allowed to continue pollution as usual provided that it pays B to reduce B's emissions to zero. Assuming that the price that B charges for the necessary pollution permits is more than B's cost of reducing emissions to zero, yet less than A's cost of reducing emissions to 50 tonnes, B makes money from the deal at the same time that A saves money. Both come out ahead – yet the same environmental goal of limiting overall pollution to 100 tonnes a year is met. No matter what size oval government regulation draws, the cost of keeping pollution within that oval will be lowered by emissions trading. Governments will thus be able to ratchet down the emissions cap (that is, draw smaller and smaller ovals) each year, as in the hypothetical case represented in Fig. 3, believing that they are doing so in the cheapest way possible.

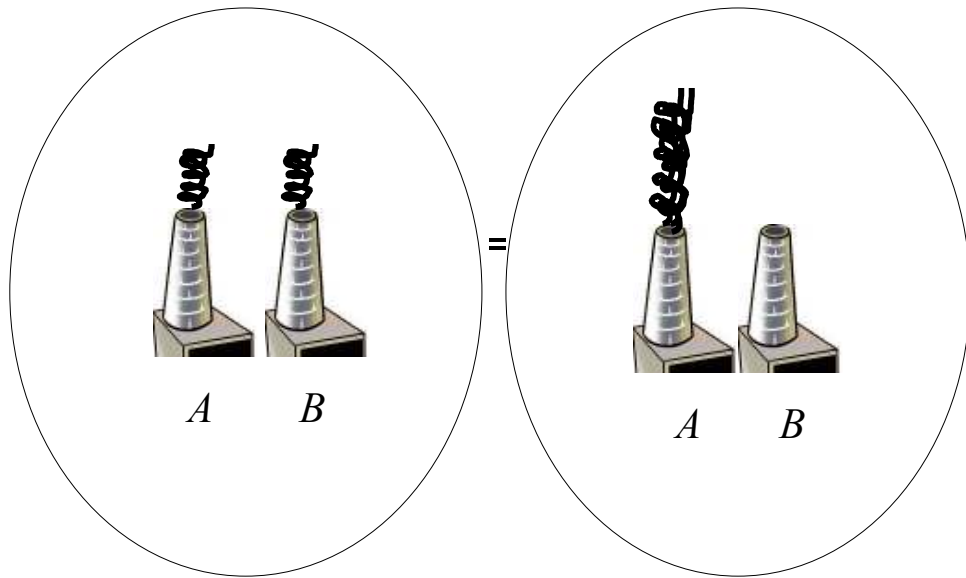


Fig. 2

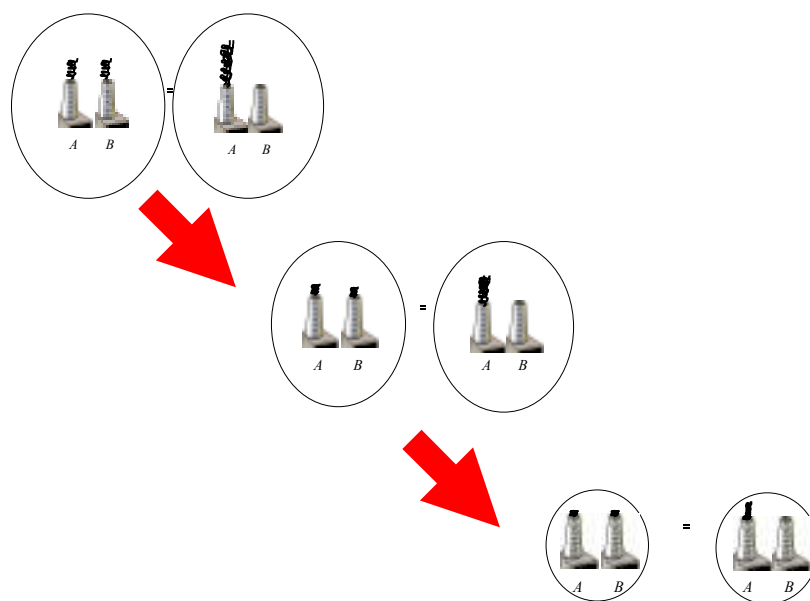


Fig. 3

This programme of commodity formation has had a number of immediate political and climatic blowbacks. First, it at once disembods the climate problem from the challenge of initiating a new historical pathway to overcome current dependence on fossil fuels, which are by far the major contributor to human-caused climate change. For industrialized countries in particular, the global warming crisis entails that an immediate<sup>92</sup> start must be made to long-range structural change at all levels of energy production and use, infrastructure, transport, agriculture, trade, community organization and so forth, as well as a shifting of state support from fossil-fuelled development toward the popular movements now at work constructing or defending low-carbon means of livelihood and social life. What that implies about future social, economic and political organization is unclear; disputes rage.<sup>93</sup> However, path dependence<sup>94</sup> and the now-undisputed need to ‘lock in’<sup>95</sup> revolutionary non-fossil energy and transport regimes within a few years suggests the necessity both for broad political mobilization and historically-informed analysis of how such structural social and technological innovation actually takes place. The drive to set up a trade in divisible, market-friendly climate benefit/disbenefit commodities goes in a different direction, recasting the climate problem itself. To investigate possible long-range social and technological trajectories or evaluate and ‘backcast’ from distant goals is to threaten the efficiency imperative. ‘What is the best way to tackle climate change?’ asked Matthew Whittell of Climate Exchange plc rhetorically in July 2008. ‘If we have a global carbon price, the market sorts it out.’<sup>96</sup>

In isolating divisible, comparable, accounting-friendly ‘emissions reductions’ as the climate solution, in other words, market architects have been able to abstract from the question of how those reductions are made, just as land markets tend to encourage abstraction from the question of how land is used. However, to make this move – which provides the quantitative framework needed for ‘efficiency’ claims and at the

same time is looked upon by political elites as a way of ‘depoliticizing’ climate action – is already to begin to detach the commodity from climate change mitigation itself. Cutting a hundred million tonnes of emissions today through routine efficiency improvements that leave a fossil-fuelled infrastructure as it is will have long-term emissions (and climatic) consequences very different from cutting a hundred million tonnes today through investment in renewable technologies with a high potential for wide adoption, or through initiating radically different ways of organizing food production.<sup>97</sup> The equivalence illustrated in Fig. 2, for example, pays no attention to what kind of industries A and B are. The ‘A’ industries – the big carbon permit buyers – are likely to be the companies most locked into fossil fuel use and therefore also the ones where change is most necessary and most urgent. Major electricity generators, for instance, are among the world’s most important producers of greenhouse gases and a prime target for early action on climate change. They tend to have billions of dollars tied up in nonconvertible fossil fuel plant whose lifetime is measured in decades. Cap and trade is designed in a way that gives such capital-intensive industries incentives for delaying structural change, not only because they have the alternative of buying (and, in the case of the EU ETS, banking) pollution permits, but also because of the unknowability of prices 40 years in the future.<sup>98</sup> Of course, it also gives incentives to ‘B’ industries – including those that may be dirty now but have the advantage of being less structurally addicted to fossil fuels – to hasten development of lower-carbon ways of doing business, and to independent businesses to develop new low-carbon technologies to sell to the ‘A’s. However, the aggregate effect is likely to be delay, together with less of the social or technological innovation of the crucial type than would be possible with more targeted forms of investment and regulation. Any entrepreneurs tempted to take advantage of the new market will concentrate on realizing the cheapest opportunities for emissions reductions first, regardless of whether they lead to long-term structural change away from fossil fuels. ‘[L]owering cost does not increase incentives for valuable innovation,’ concludes emissions trading expert David Driesen, noting that there is ‘a tradeoff between short-term cost effectiveness and investment in ... long-term economic and environmental progress’ ... targeted regulatory programmes encourage renewable energy development better than global emissions trading programmes.<sup>99</sup> Other experts agree that carbon prices are unlikely to be able to ‘deliver the escape velocity required to get investment in technological innovation into orbit, in time,’ particularly in the absence of a ‘significant increase in publicly funded research and development for clean energy technology and changes to innovation policies,’<sup>100</sup> that while they may be ‘quite effective for introducing changes on the margin ... there is little evidence of price incentives inducing a fundamental transformation in the economy or society.’<sup>101</sup> The carbon price, argues Jim Watson of the Energy Group at Sussex University,

‘... is a very poor weapon in what is supposed to be a war to save humanity ... Governments are relying way too much on the price of carbon to deliver everything ... It has to go hand in hand with regulations and technological developments, and they are sadly lacking ... The oil price shocks of the 1970s didn’t wean us off oil, so why should we believe that a high carbon price will wean us off carbon?’<sup>102</sup>

Such conclusions echo those of maverick economists in the orthodox tradition, such as W. Brian Arthur, who suggest that in contexts in which increasing returns are significant, leaving research and development of critical technologies largely to private firms incentivized by price – one of the premises of the carbon market –

cannot guarantee that the ‘fittest technology in the long run sense will be the one that survives.’<sup>103</sup> The dislodging of path-dependent systems, as Gwyn Prins and Steve Rayner observe, ‘is usually initiated by quite unexpected factors resistant to being accounted for in advance’.<sup>104</sup> To put the point in a way that connects it more closely to the financial crisis, systemic risk escalates when incentives for structural change in the polluting buying sector are blocked. The project of finding a ‘cost-effective way of addressing global warming’ through carbon markets becomes incoherent insofar as creating the market framework necessary to make sense of the notion of ‘cost-effectiveness’ entails losing touch with what is supposedly being costed.

The US’s pioneering cap and trade system for achieving cost savings in reducing sulphur dioxide – which was the main model for the Kyoto Protocol and subsequent carbon trading systems – offers some empirical illustration of the point. According to staff of the Environmental Protection Agency, speaking in their personal capacity, ‘the few and relatively minor experiments in emissions trading in our country have produced virtually no technological innovation, much less the kind of innovation necessary to power our economy on renewable resources rather than fossil fuels.’<sup>105</sup> The sulphur dioxide trade may or may not have saved money in attaining limited reduction goals, but in any case it did not foster technological innovation of the type that would be relevant to the climate crisis.<sup>106</sup> Los Angeles’s Regional Clean Air Incentives Market, to cite another example, appears to have sidelined developments in fuel cells, low-emitting burners and turbines that had previously been subsidised by a percentage of car registration fees, and the failure of at least one emerging method of reducing nitrogen oxides to break into the market can be attributed to the ‘spatial flexibility’ provided by trading, which allowed emitters to ignore innovative but still expensive technology options.<sup>107</sup> Innovations under the ‘bubbles’ of early US pollution trading programs also tended merely to be rearrangements of conventional technologies rather than the invention, development or commercialisation of technologies likely to be useful for achieving a longer-term social or environmental goals.<sup>108</sup>

Cap and trade may also interfere even more directly with technological renewal. For example, the UK government openly admits that because large-scale energy producers ‘are covered by the EU Emissions Trading Scheme,’ official renewables strategy has no provisions for setting large-scale energy production on a different technological path.<sup>109</sup> A leaked document suggests, in addition, that one reason that the British government is reluctant to pursue renewable energy targets is that they would threaten EU ETS carbon prices and the survival of the London financial district’s growing carbon trading industry.<sup>110</sup>

Yet despite the weight of evidence, the neoclassical mystique that it ought to be possible to incentivize effective climate action primarily by price continues to exert its hold, not least on key governments and middle-class environmentalists in industrialized countries. It is commonly felt that in theory, at least, there must be an ideal ‘Goldilocks’ range of carbon prices, high enough to select for ‘the necessary fundamental overhaul of energy systems’<sup>111</sup> even in the absence of dedicated public investment programmes, redirected research and development and the like, yet not so high that they irreparably damage the profits of the crucial corporations that the system is designed to accommodate. However, there are some signs that this belief is being eroded – if only very slowly – by the scorn of economists such as Jeffrey

Sachs,<sup>112</sup> the opposition of environmental justice groups and, perhaps most importantly, the accumulating lessons from the recent history of price politics in pollution trading schemes.

One such lesson comes from the EU ETS, under which initial emissions budgets were absurdly generous. In the first phase, the largest industrial greenhouse gas emitters in Europe were granted more rights to emit greenhouse gases than they needed to cover their current emissions. The result was the carbon market's first big price crash (to close to zero) in April 2007. Playing some part in this embarrassment were measurement and verification failures involving, among other things, falsified corporate emissions histories, and monitoring and enforcement limitations are likely to continue. Cap and trade demands a far more sensitive, centralized and powerful state apparatus for measurement and enforcement than is needed for conventional regulation,<sup>113</sup> and even in most industrialized countries, the emissions measurements needed to underpin trading, or even to detect compliance with Kyoto targets, are not being made, rendering the existing carbon emissions commodity largely fictitious even in its own terms. As climate change expert Steve Rayner points out, 'the cap-and-trade approach relies on underdeveloped monitoring and accounting systems that inevitably leave plenty of wiggle room for unscrupulous speculators to work the system, amassing fortunes while achieving nothing for the atmosphere.'<sup>114</sup>

Just as significant is the rent-seeking that is also endemic to carbon markets, and that gives them special vulnerability to regulatory capture. Corporations aware that the grants of carbon permits they are being allocated are a lucrative asset (the Kyoto Protocol, the EU ETS, and all other existing cap and trade systems are overwhelmingly 'polluter earns' arrangements: the lion's share of pollution rights is simply given away free to the biggest emitters) simply lobby governments for as much as they can get, taking advantage of inadequate emissions verification requirements. Under the EU ETS, accepted accounting procedures meant that electricity generators such as RWE, CEZ and Scottish Power were able to pass on to consumers the nominal 'opportunity cost' of withholding their free carbon assets from the market. It is estimated that in five European countries, windfall profits for power generators from cap and trade will reach US\$112 billion by 2012.<sup>115</sup> Much of this free money is being ploughed back into long-term fossil fuel investments, further locking in global warming. Environmental groups' belated attempts to reduce the damage done by the EU ETS by insisting on permit auctioning, or at least stricter limits on the gift of excess pollution rights to Europe's worst greenhouse offenders, have proved no match for industrial lobbies,<sup>116</sup> who have also not hesitated to deploy lawsuits and diplomatic pressure to resist official attempts to tighten caps. To the limited extent that caps are nominally being tightened, moreover, 'holes' are being punched in them to admit a flood of carbon credits from outside the EU (one effect of the multi-stage commodity formation process diagrammed in Fig. 1 is that 'offset' credits become mixed with emissions allowances), in effect loosening emissions regulation (see below).

Where pollutant prices do rise to a meaningful level, whether by accident or design, a similar politics applies. In California, for example, the price of permits to emit particulate matter approaches half a million dollars per kilogramme – a price high enough, it would seem, to constitute a serious clean-up incentive for fossil fuel-dependent electricity generators. But because power generation is still 'locked in' to

particulate-emitting technologies, individual corporations and their state benefactors seek ways of avoiding permit costs. Hence a proposal to create a ‘reserve’ of permits valued at hundreds of millions of dollars to give out free of charge to the offending corporations<sup>117</sup> – in effect invalidating the entire rationale of the trading system. Similarly, if structural alternatives to fossil fuel dependence do not become available through non-price action, any steep emissions cuts are likely to result in unmanageable price increases, bankruptcies and, ultimately, legislation to relax caps or scrap trading entirely.

In addition to abstracting from the question of how reductions are made, cap and trade is also designed to abstract from the question of where they are made. Commensuration of place is built into its design; redistributing pollution around the landscape to ‘maximize cost-effectiveness’ is part of its structure. Typically, in line with carbon trading’s (mis)identification of climate solutions with emissions reductions, this commensuration is justified by chemistry: ‘carbon is carbon, wherever it enters the atmosphere’. The experience of the US with previous pollution trading schemes again discloses the ‘cost’ of this ‘cost-effectiveness’: since the industries most firmly locked into fossil fuel exploitation or use, and most likely to be carbon permit buyers, tend disproportionately to affect poorer and disadvantaged communities, cap and trade strengthens environmental racism and other forms of discrimination.<sup>118</sup> Lower-income communities are far more likely than others to play host to the ‘A’ industries of Fig. 2. Although national sulphur dioxide emissions from power plants decreased by 10 per cent from 1995 to 2003 under US sulphur dioxide trading, more than half of the US’s dirtiest power plants increased their annual soot-forming SO<sub>2</sub> emissions over the period. As a result, ‘communities living in the shadows and downwind of these polluting power plants are actually breathing dirtier air.’<sup>119</sup> Cap and trade’s built-in insensitivity to the different ecological effects that pollution can have in different biomes creates additional environmental and social problems.

Another accompaniment of commodification that ‘blows back’ on efforts to achieve climate goals is privatisation, enclosure, or ‘primitive accumulation’. In order to be bought and sold, any climate commodity must be specified and measured. If the climate commodity is interpreted as the earth’s ability to maintain a stable climate, and thus to regulate levels of carbon dioxide in its atmosphere, then that ability must be isolated and quantified. How much space exists in the interlinked above-ground system of oceans, surface rock, soils, vegetation, and air in which carbon from underground fossil sources might be safely dumped?<sup>120</sup> The answer depends both on what kind of world is considered tolerable and what the likely physical response will be of that above-ground system to the increasing load of fossil carbon with which it has to cope. No non-political answer can be found to the first question, and no probabilistic answer can be found to the second due to the many unknowns, indeterminacies, nonlinearities, unknowables and ‘monsters’ of the climate system.<sup>121</sup> Politics and climatology therefore militate against a climate commodity’s being either specifiable or quantifiable, much less divisible into the sort of tradeable elements that, as shown above, ultimately become the object of rent-seeking. Nevertheless, the pressure to create a market, combined with ingrained habits of linear thinking, have resulted in numerous quantist efforts to measure what would be a ‘safe’ concentration of carbon dioxide in the atmosphere, as well as to conduct cost-benefit analyses (CBAs) that commensurate climate damage with economic gains and losses from

taking climate action. This pressure is felt not only by politicians but also by climate scientists themselves.<sup>122</sup> As the Harvard economist Martin Weitzman has recently written in a rebuke to Nicholas Stern, it is

‘understandable ... to want climate-change CBA to be restricted to dealing only with modest damages by disregarding nightmare scenarios (as being ‘too speculative’ or ‘not based on hard science’) via chopping off the really-bad tail and then ignoring it. This is the *de facto* strategy employed by most of those relatively few existing CBAs of climate change that even bother to concern themselves at all with a formal treatment of uncertain high-impact damages.’

But the consequences, Weitzman cautions, include a dangerously degraded conception of the climate problem itself. In words that might have come out of the mouths of trader-critics of the Black-Scholes option-pricing equation, Weitzman critiques the commensuration process inherent in multi-equation, computerized Integrated Assessment Models (IAMs), which aggregate economic growth with simple climate dynamics to analyze the economic impacts of global warming. He suggests that

‘the climate-change economist can help most by not presenting a cost-benefit estimate for what is inherently a fat-tailed situation with potentially unlimited downside exposure as if it is accurate and objective – and perhaps not even presenting the analysis as if it is an approximation to something that is accurate and objective – but instead by stressing somewhat more openly the fact that such an estimate might conceivably be arbitrarily inaccurate depending upon what is subjectively assumed about the high-temperature damages function along with assumptions about the fatness of the tails and/or where they have been cut off. Even just acknowledging more openly the incredible magnitude of the deep structural uncertainties that are involved in climate-change analysis – and explaining better to policy makers that the artificial crispness conveyed by conventional IAM-based CBAs here is especially and unusually misleading compared with more-ordinary non-climate-change CBA situations – might go a long way towards elevating the level of public discourse concerning what to do about global warming. All of this is naturally unsatisfying and not what economists are used to doing, but ... we may be deluding ourselves and others with misplaced concreteness if we think that we are able to deliver anything much more precise than this with even the biggest and most-detailed climate-change IAMs as currently constructed and deployed.’<sup>123</sup>

In addition to undermining scientific understanding of the climate crisis, the attempt to privatize the world’s carbon-cycling capacity also gives rise to distribution questions which, even in the absence of the potentially disastrous results of commodity quantification, are likely eventually to flare into international political conflict. On any numerical estimation of the extent of the earth’s carbon-cycling capacity, for example, the industrial North, through the EU Emissions Trading Scheme, has already appropriated more than its share of what was heretofore an unclaimed global good. If it is assumed, in accordance with the 2001 recommendation of the IPCC, that human societies have to cut their use of this capacity to 20 to 40 per cent of the current figure within a few decades, and thus that the nominal ‘size’ of the capacity is 20 to 40 per cent of what is currently being used, then it follows that Europe, in the first phase of the EU Emissions Trading Scheme, appropriated between

17 and 34 per cent of the world's carbon dump, far out of proportion to Europe's relative population. Assuming even a very low carbon price, this translates into the unilateral creation and acquisition of assets worth many billions of dollars yearly.<sup>124</sup> The nationally and internationally skewed benefits of carbon markets, unsurprisingly, have been closely connected with their ineffectiveness in addressing climate goals. No less a figure than Citigroup's Head of European Utility Research Peter Atherton has summed up the impact of the EU ETS as follows: "All generation-based utilities: winners. Coal and nuclear generators: Biggest winners. Hedge funds and energy traders: even bigger winners. Losers?? Herm ... consumers!" Atherton goes on to observe, "Have policy goals been achieved? Prices up. Emissions up. Profits up. ... So, not really."<sup>125</sup>

Yet cap and trade's structural biases toward the short-term interests of heavy-polluting industry and the wealthy are frequently cited as political virtues by governments, economists, environmentalists and commentators.<sup>126</sup> It is often argued, for example, that reliance on a trading mechanism that discourages immediate steps toward a long-term transition away from fossil energy is the price that has to be paid for governments' ability to persuade corporations to accept emissions caps of reasonable severity. Without trading, it is suggested, serious regulation would be politically impossible, whereas with trading, governments will be able to impose caps that will create a cost for carbon – and possibly even some day to drive that price high enough to force the 'A' industries of Fig. 2 to undertake long-term structural change. In addition, it is pointed out, transforming the Kyoto Protocol into a trade treaty setting up a new market was necessary for getting the US to initial the Protocol in 1997, even though it later pulled out. The reflexive identification of climate solutions with emissions cuts and prices evident in such arguments indicates the remarkable degree to which commodified climate action has been 'naturalized' among the intelligentsia in industrialized countries in the space of little more than a decade. It is not only that the way commodification 'distances' cap and trade from the climate problem is ignored. Largely eclipsed also is the long history of non-trading state intervention in environmental issues<sup>127</sup> as well as contemporary successes in conventional pollution regulation, for example in Germany, which has been able to make deeper cuts in sulphur dioxide emissions from power plants than the US did without trading,<sup>128</sup> and when even the US has succeeded in banning or limiting many pollutants without trading or even much concern with cost.<sup>129</sup>

### *Offsets*

Carbon offsets constitute a further development of the climate commodity, reinforcing the climatic, political and social 'blowbacks' of cap and trade while adding some new ones of their own, disconnecting carbon markets still further from the climate problem and storing up market valuation problems for the future. In the Kyoto market, offsets were devised partly as a compromise between wealthy industries' and states' desire for an additional source of pollution rights to enable them to 'buy time' before reducing their own emissions and, on the other, the desire of Southern states for some financial benefit from the international climate regime. Outside the Kyoto framework, they serve a mix of purposes, including compliance with emissions laws, public relations, educational tool, and modern-day indulgence.<sup>130</sup>

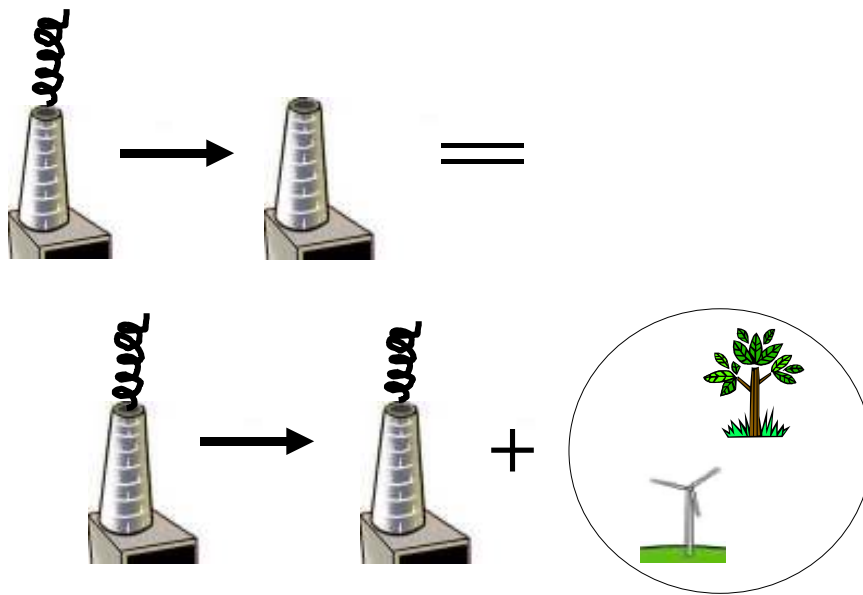


Fig. 4

Like cap and trade, offsets rely on the creation of new equivalences (Fig. 4). In this case the principal equivalence is between emissions reductions and purportedly ‘carbon-saving’ projects. Instead of cutting their greenhouse gas pollution (top arrow), industries, nations or individuals finance a mixed and ingenious range of schemes elsewhere (bottom right), which are cheaper to implement. As mentioned above, examples include carbon sequestration schemes such as plantations or ocean-fertilization projects as well as dams, wind farms, fuel switches, efficiency schemes, fly-ash or coal-ash reprocessing programmes, and other projects that can be argued to result in less greenhouse gas being released to the atmosphere than would otherwise be the case. Just as cap and trade commodifies the earth’s carbon-cycling capacity before parcelling it out to polluting industries, so too many offsets tend to commodify land, water, air, genes and community futures in new ways in order to ‘expand’ that global capacity to allow more use of fossil fuels. Although many offsets are constructed in industrialized countries including the US, most sites for this new form of commodification within the Kyoto market are in the global South, particularly countries such as China, India, Korea and Brazil. That means that carbon trading affects less-industrialised countries not only indirectly, through any hastening effect cap and trade has on climate change, but also directly, by encouraging the development of ‘offset’ projects designed to license continued emissions by industrialised countries.

For example, the German-based energy company RWE plans to meet its pollution targets under the EU ETS not by cutting its emissions significantly, but rather by investing in UN-backed ‘offset’ projects destroying N<sub>2</sub>O (a powerful greenhouse gas) at factories in Egypt and South Korea and HFC-23 (an even more powerful climate-forcing gas) at chemical plants in China. Such ‘industrial gas’ projects, along with similar schemes to burn methane associated with oil wells or coal mines, become a spectacularly ‘efficient’ way of addressing climate change – in spite of the fact that they do nothing to address the fossil fuel question – because of the equivalences set

up by climate market architects among various greenhouse gases. (Fig. 5 represents one equation provided by the Intergovernmental Panel on Climate Change to help construct an omnibus climate commodity – in this case stipulating a conversion factor between methane and carbon dioxide. A single methane molecule [left] is said to have the same ‘global warming potential’ as nearly a dozen carbon dioxide molecules [right] – although numerous incommensurabilities between the two substances with respect to residence time and location in the atmosphere, type of physical interactions, etc. make the equivalence scientifically questionable. Similar equations are provided for N<sub>2</sub>O and HFC-23; tellingly, the conversion factor for HFC-23 – inevitably partly arbitrary – was recently revised by over 26 per cent, enabling the production of millions of tonnes more carbon credits).<sup>131</sup> RWE is also exploring the possibility of buying carbon credits from projects that would capture and burn methane (yet another harmful greenhouse gas) from landfills and coal mines in China and Russia, and another 90 million tonnes of CO<sub>2</sub> emission rights from a range of projects in India.<sup>132</sup>

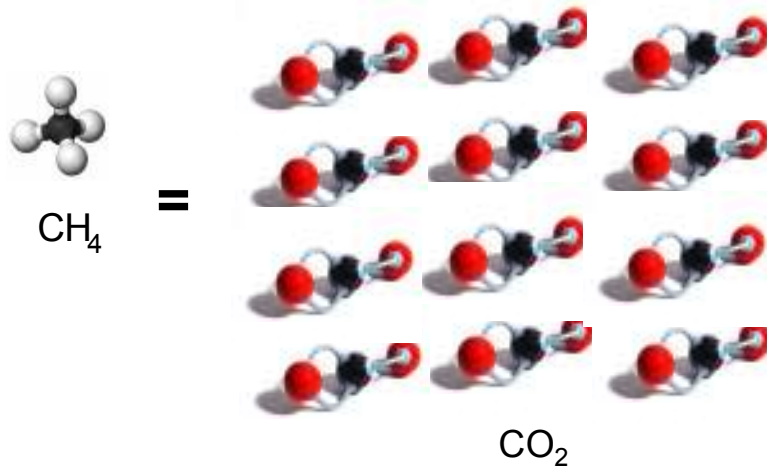


Fig. 5<sup>133</sup>

Overall, the European Union has proposed that member states be able to use offset credits to meet up to 25 per cent of their national emission reduction targets in the period leading up to 2020.<sup>134</sup> In reality, the dominant EU-15 group of countries plans to meet nearly 38 per cent of the cuts required to meet its 2008-2012 target through overseas-originated offset credits (Fig. 6).<sup>135</sup> Even by their own admission, 11 out of the EU-15 will not have reduced their own fossil fuel emissions enough to meet the Kyoto targets by 2010.<sup>136</sup> Seeking carbon brokerage business, Wall Street firms have meanwhile lobbied for an increasing proportion of carbon offsets to be allowed in US cap-and-trade systems as well.

## Cap and trade + offsets (Caps with holes)

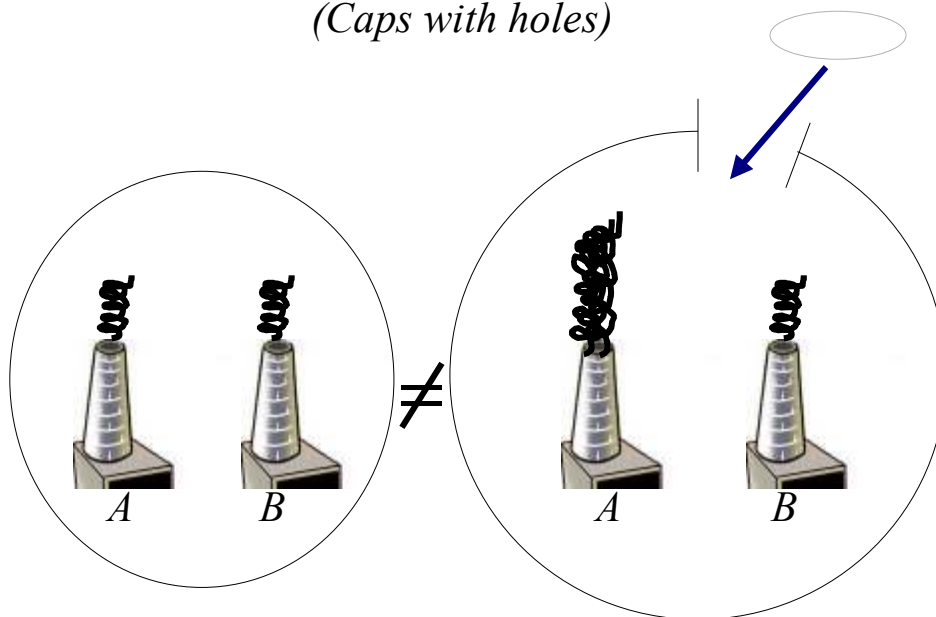


Fig. 6

More transparently than cap and trade, then, offsets are designed in a way that helps entrench or even increase dependence on fossil fuels in the industrialised North. In addition to the blowback of probably further destabilizing climate, that provokes the opposition of many Northern renewable energy developers as well as Northern environmentalists seeking emissions reductions at home. California's environmental justice movements, for example, see carbon trading as a 'charade to continue business as usual'.<sup>137</sup> Carbon trading, they note, is threatening promising efforts to prevent the state from building 21 planned fossil-fuelled generating plants – all to be located in poorer, predominantly nonwhite communities – and set itself on the path to a greener society. The California groups argue that carbon trading would channel funding into out-of-state carbon offsets at a time when it should go instead toward a renewable energy refit programme that would make large numbers of green jobs possible for underprivileged communities. If the state government decides to back carbon trading, wrote one state senator, 'it could very well harm low income residents, make fewer funds available for energy efficiency investments and renewables, and undermine Los Angeles' ability to reach its goals'.<sup>138</sup>

Offsets are nevertheless often defended as a way of helping to finance the South's efforts to embark on a 'greener' development path, and perhaps also provide a stimulus to Northern exporters to develop innovative renewable energy technologies. Yet the evidence so far indicates that the bulk of offsets set up under the UN's carbon market reinforce a fossil-dependent industrial path in the South as well as the North, further exacerbating climate change. Most Kyoto Protocol carbon offset credits are generated not by renewable energy but by projects that contribute nothing to a transition to a non-fossil dependent society. As of December 2008, three-quarters of Kyoto offset credits issued were manufactured by large firms making minor technical adjustments at a few industrial installations to eliminate HFCs and N<sub>2</sub>O. No credits

came from the development of solar or tidal power.<sup>139</sup> By 2020, the proportion of credits from HFC and N<sub>2</sub>O projects is expected to decline to a quarter (although increasing tenfold in absolute terms), but not because of any trend toward projects which verifiably curb the flow of fossil carbon out of the ground, but through a growth in, for example, credits from hydropower projects (over 19 per cent), most of which were planned or under construction before carbon finance was even considered,<sup>140</sup> landfill gas burning projects (8 per cent), fuel switches (7 per cent) and schemes to burn off methane seeping from coal mines (5 per cent). Credits from solar and tidal power will remain negligible, and although wind power credits will rise to 8 per cent of the total, the degree to which wind displaces, rather than simply adds to, fossil energy, is disputed, as are the other benefits of giant industrial wind farms.<sup>141</sup> Offset projects undertaken outside the Kyoto framework have a profile which in some ways is even more supportive of expanded fossil fuel use: offsets being sold on the voluntary market include credits generated by using carbon dioxide to pump out the remaining sticky oil at the bottom of nearly-exhausted wells, and there is strong lobbying to allow coal-burning power plants to generate further pollution rights by capturing carbon dioxide out of their stacks, liquefying it, and pumping the strongly alkaline product into underground 'toxic waste dumps'.<sup>142</sup>

An additional way in which the carbon credit trade is creating environmental blowbacks is illustrated by Rhodia (France)'s adipic acid plant in South Korea.<sup>143</sup> Keen to benefit from the Kyoto market, Rhodia invested US\$15 million in equipment that destroys nitrous oxide. Because N<sub>2</sub>O is a greenhouse gas stipulated to be 310 times more dangerous than carbon dioxide, and because Rhodia owns a plant located in the global South, it can generate 310 tons of carbon credits just by burning one tonne of the compound, thus enabling production of \$1 billion in UN-approved carbon credits for sale to polluting industries in industrialized countries. The trade does not reduce overall greenhouse gases, because customers buy Rhodia's credits only so that they can continue to invest in fossil fuels. Nor does it help Korea decarbonize: at best, it is irrelevant; at worst, it encourages the country to build more dirty industries so that it can make money cleaning up later, as has already happened with the HFC-23 trade.<sup>144</sup> Rhodia already makes 35 times more money selling carbon credits than it does from the adipic acid market. Nor does the trade incentivize green technological innovation. The technology Rhodia uses dates from the 1970s.

It is sometimes claimed that once the market has picked this type of 'low-hanging fruit' from the offset orchard, it will seek out more difficult, expensive and useful schemes. The idea, again, is that although carbon trading admittedly brings about delays in needed reinvestment, eventually it will direct finance to the right places. However, this is to misunderstand the structure of the incentive that offset trading provides, which is directed not at stimulating innovators to develop climate solutions, but rather to find or invent new 'emissions equivalents' that can be used in manufacturing substantial blocks of cheap carbon credits for sale. The last decade has seen proposals for carbon offsets ranging from rearranging traffic signals to seeding the oceans with urea to stimulate algal growth to not cutting forests and not riding elevators; in the words of one carbon banker, 'we will not run out of cheap CDM options any time soon.'<sup>145</sup> The goals of finding climate solutions and inventing new 'emissions equivalents' are not only not the same, but are in many ways opposed. In this, again, carbon markets are parallel to today's derivative markets, which incentivize innovators continuously to seek new ways of pricing an inherently

unpredictable future in ways that actually increase the chances of financial crashes rather than improving livelihood and ensuring sustainability.

The Kyoto offset market's structural bias in favour of fossil fuels is reinforced by the reality that the companies best equipped to gain regulatory permission to sell carbon credits are well-capitalized, often fossil-dependent corporations with government connections and the ability to hire carbon consultants and accountants. In many ways, in fact, their profile is similar to that of industrial credit buyers. While industrial buyers include, unsurprisingly, such large-scale corporate greenhouse gas producers as Shell, BHP-Billiton, EDF, Endesa, Mitsubishi, Cargill, Nippon Steel, ABN Amro and Chevron, major carbon credit sellers include corporations that share the same fossil orientation, such as South Africa's Sasol, India's Tata Group, ITC, Birla, Reliance and Jindal, Korea's Hu-Chems Fine Chemical and so forth.<sup>146</sup> Such well-financed companies use the carbon offset market not as a way of propelling their countries away from fossil dependence, but generally as a means for topping up finance for environmentally-damaging projects to which they are already committed. As a top official at the Asian Development Bank, which itself has attempted to use the carbon market as a slush fund to prop up its portfolio<sup>147</sup> admits,

'When the CDM was introduced 10 years ago, there was much expectation from the developing countries that it would provide the necessary upfront financial and technical support for new sustainable development projects that would reduce greenhouse gas emissions. Today . . . it is mostly functioning to provide additional cash flow to projects that are already able to move forward with its [sic] own financing.'<sup>148</sup>

Carbon credit investors in the financial sector, who today dominate the buyers' side (see Tables 1 and 2), have also repeatedly been explicit that offset economics does not select for a transition away from fossil fuels. Historically, such buyers have focused on large blocks of low-cost, easy-to-obtain pollution licenses, being reluctant to involve themselves in projects involving sustainability considerations and local sensitivities. 'We look at the market price. We don't look at any particular technology,' explains Louis Redshaw of the Emissions Trading Department of Barclays Capital.<sup>149</sup> 'The carbon market doesn't care about sustainable development,' confirms Jack Cogen of Natsource. 'All it cares about is the carbon price.'<sup>150</sup> Richard Sandor, the derivatives trader who set up the Chicago Climate Exchange, told the *Wall Street Journal* in October 2008 that whether it is carbon finance or some other factor that results in his contractors making the emissions cuts that they use to claim carbon credits is 'not my business. I'm running a for-profit company.'<sup>151</sup>

Unsurprisingly, community-based carbon-saving or renewable energy projects have found it difficult to tap into the carbon market while maintaining the quality of their work.<sup>152</sup> As one veteran renewables activist and specialist in Africa put it, 'When the company for which I worked for 10 years got into carbon trading, I became increasingly distraught. It was no longer about 'sustainable development', it was about tonnes of CO<sub>2</sub> on make-believe spread sheets' (Anon 2007).<sup>153</sup>

**Table 1.**  
**Buyers of Kyoto market carbon credits from large-volume sources**

<b>TYPE OF PROJECT</b>	<b>AVERAGE SIZE</b>	<b>FINANCIAL SECTOR BUYERS</b>	<b>OTHER BUYERS</b>
HFCs	3.7 m tonnes	Barclays, Bear Stearns, BHP Billiton Marketing, BNP Paribas, British Gas Trading, Climate Change Capital, Comercio Internacional Proserdi, Deutsche Bank, EcoSecurities, EDF Trading, Fortis, Goldman Sachs, IBRD, ICECAP, Incorporated MIT Carbon Fund, IXIS, JBIC, JMD Greenhouse Gas Reduction, Marubeni, Mitsui, Morgan Stanley, NATIXIS, Natsource, Noble Carbon, Oz Carbon Trading, Rabobank, Sumitomo Bank, Trading Emissions, Zeroemissions Carbon Trust	Aalborg Portland, Azuliber, Carbon Compliance Acquisition 5, Cementerie Aldo Barbetti, Cementos Portland Valderrivas, CEPSA, CER Investments 1, Chubu Electric, Chugoku Electric, Daioh Construction, Danish Ministry of Climate and Energy, DONG, Electrabel, Endesa, ENEL, ERG, Fortum, Gas Natural SDG, Government of Canada, Government of Sweden, Hidroelectrica del Cantabrico, Iberdrola, IFJ Korea, Iride Mercato, Italcementi, Italian Ministry of Environment, Ineos Fluor, JGC, J-Power, KfW, Kyushu Electric, Maersk, Mitsubishi, Nippon Steel, Nordjysk Elhandel, Nuon, Repsol, RWE, Semptra Energy Europe, Shandong Dongyue Chemical, Shell Trading, Shikoku Electric, Solvary Fluor, Statkraft, Tohoku Electric, Tokyo Electric, Union Fenosa, VROM
PFCs	1.4 m tonnes	South Pole Carbon Asset Management, 33 Asset Management	–
Wind	0.8 m tonnes	BNP Paribas, BP Gas Marketing CAF, Cambridge Funds Investment, CAMCO, Cantor Fitzgerald Europe, Carbon Asset Management Sweden, Carbon Capital Markets, CarbonNeutral Company, Carbon Resource Management, Climate Change Capital, Climate Change Investment, Credit Suisse, Daiwa Securities, Deutsche Bank, Ecoinvest Carbon, EcoSecurities, EDF Trading, Essent Energy Trading, European Carbon Fund, First Carbon Fund, Fortis, Grey K Environmental, Goldman Sachs, IBRD, ICECAP,	Cargill, CERUPT, CEZ, Chubu Electric, Chugoku Electric, Converging World, Danish Ministry of Climate and Energy, Econergy, Electrabel, Endesa, ENEL, Enerfin Enervento, Eurus Energy, Finland Ministry for Foreign Affairs, Fortum, Gamesa, Gaz de France, Government of Canada, Iberdrola, Inversiones Celco, BIC, KfW, Kyushu Electric, Lafarge, Mitsubishi, NEDO, Ricoh, RWE, Scottish and Southern Energy, Shell Trading, Shikoku Electric, Sojitz, Statoil, Swedish

		IXIS, J. Aron, Japan Carbon Finance, JBIC, Kommunalkredit, Marubeni, Merrill Lynch, MGM Carbon Portfolio, Mitsui, NATIXIS, OneCarbon, Pacific Consultants International, Rabobank, Renaissance Carbon Investment, Spanish Carbon Fund, Standard Bank, Sumitomo Bank, Trading Emissions, Vitol, World Carbon Credit Investment	Energy Agency, Swiss Re, Tohoku Electric, Tokyo Electric, Voestalpine, VROM
N <sub>2</sub> O	0.7 m tonnes	Ecoinvest Carbon, EcoSecurities, Fortis, Goldman Sachs, Kommunalkredit, Marubeni, MGM Carbon Portfolio, Mitsui, N.serve, NATIXIS, Natsource, Noble Carbon, ORBEO, Sindicatum Carbon Capital, Vitol	Johnson Matthey, Mitsubishi, Rhodia Energy, RWE, Toyo Engineering,
Coal bed/mine methane	0.45 m tonnes	Arreon Carbon UK, CAMCO, Climate Change Capital, Credit Suisse, Eco-Carbene, EcoSecurities, EDF Trading, Energy Systems International, Equity Environmental Assets, European Carbon Fund, Fortis, IBRD, ICECAP, IXIS, Japan Carbon Finance, Kommunalkredit, Lehman Brothers, Marubeni, Merrill Lynch, MGM Carbon Portfolio, Mitsui, NATIXIS, Natsource, ORBEO, Renaissance Carbon Investment, Sindicatum Carbon Capital, Trading Emissions, Vitol	CEZ, Chogoku Electric, JGC, MTM Capital Partners, RWE, STEAG, Tokyo Electric, Toyota

Source: UNEP Risoe Centre, [www.cdmpipeline.org](http://www.cdmpipeline.org)

**Table 2.**  
**Top 20 Kyoto market carbon credit buyers (number of projects)**

Buyers (sector)	No. of projects
EcoSecurities (carbon finance, brokerage and consulting)	296
Carbon Asset Management Sweden (carbon finance)	132
AgCert (carbon finance)	97
EDF Trading (carbon finance)	87
IBRD (banking)	84
RWE (utilities)	80
Cargill International (agribusiness)	78
Mitsubishi (technology)	72
Trading Emissions (carbon finance)	68
ENEL (utilities)	63
Vitol (oil trading)	60
MGM Carbon Portfolio (carbon finance)	59
Agrinergy (carbon finance)	58
Carbon Resource Management (carbon finance)	57
CAMCO (carbon finance)	56
Marubeni (carbon finance)	53
Kommunalkredit (banking)	53
Essent Energy Trading (carbon finance)	51
Climate Change Capital (carbon finance)	44
Energy Systems International (carbon finance)	43

*Source: UNEP Risoe Centre, [www.cdmpipeline.org](http://www.cdmpipeline.org)*

From a financial engineering point of view, offsets present a particularly ‘bizarre’ form of futures trading: this is, after all, a ‘market for not producing something in the future’ and involves allowing ‘undesirable carbon to be produced for you by someone else as well as yourself on the grounds that they might produce less of it than you would if you were producing what they produce as well as what you yourself will carry on producing.’<sup>154</sup> But like the rest of the financial derivatives market, the offset market necessarily involves efforts to domesticate, simplify and quantify unknowns. In particular, all carbon credit accounting (and thus carbon accounting *tout court* in any market that attempts to make cap and trade allowances and carbon offset credits fungible), relies on expert assessment of counterfactual scenarios. The credits generated by a greenhouse gas-saving project built as a result of carbon finance are calculated by showing how much less greenhouse gas is entering the atmosphere as a result of their presence than would have been the case otherwise. That is, the emissions associated with each with-project scenario must be subtracted from the emissions associated with a unique, otherwise identical, business-as-usual storyline. Hence just as financial quants attempt to disaggregate different kinds of uncertainty from their contexts, carbon accountants must disentangle the project from an imaginary ‘baseline’. This counterfactual without-project scenario is presented not as indeterminate and dependent on political choice but as measurable, singular, determinate and a matter for economic and technical prediction. The market dictates, in other words, that without the offset, only a single world is possible. As many offset proponents, analysts and accountants themselves privately acknowledge, such a claim

can have no scientific basis – project baselines ‘cannot be measured’<sup>155</sup> – and the market’s requirement for proof that each project is ‘additional’ in this way has attracted even more professional ridicule than the risk management models that quants have attempted to apply in the derivatives markets. Thus: ‘Offsets are an imaginary commodity created by deducting what you hope happens from what you guess would have happened.’<sup>156</sup> ‘If you are a good storyteller you get your project approved. If you are not a good storyteller you don’t get your project through.’<sup>157</sup> (Such storytelling is of course also part of the quant project in finance, a fact of which quants themselves tend to be better aware than their public.) Project proponents ‘tell their financial backers that the projects are going to make lots of money’ at the same time they claim to regulators ‘that they wouldn’t be financially viable.’<sup>158</sup> Biotic carbon offsets have offered up still further measurement impossibilities to carbon market quants, who have nevertheless not shrunk from trying to evolve methodologies for the use of the market.<sup>159</sup> Indeed, the unverifiability of offset quantification makes it relatively easy for skillful and well-paid carbon accountants whose work is largely shielded from public scrutiny<sup>160</sup> to help fabricate huge numbers of pollution rights for sale to Northern fossil fuel polluters, who are only too happy not to inquire too closely into their origin. At the same time, it makes impossible any distinction between fraud and non-fraud, rendering any attempt at regulation ultimately pointless.<sup>161</sup>

The resulting asset valuation problem that is being stored up is perhaps even more obvious than the subprime mortgage problem was before the 2007-08 crash. One 2007 study concluded that most of the several hundred hydropower projects in the Kyoto offset pipeline in China were well advanced before carbon finance could have become a factor in their construction,<sup>162</sup> another investigation of projects in India found that a third of the sample was not ‘additional’,<sup>163</sup> a third investigation elicited admissions from managers of carbon finance-supported projects in Bulgaria and Britain that their schemes, too, would have been instituted with or without carbon money.<sup>164</sup> ‘We don’t want an Enron scandal where excess credits are issued without the actual reductions taking place,’ fretted one executive of Det Norske Veritas, one of the ‘big four’ private agencies licensed by the UN to validate and verify carbon credits, in 2006; two years later, in December 2008, the UN suspended his company from verifying Kyoto offsets after an investigation revealed irregularities in its auditing procedures.<sup>165</sup> Because the net carbon effect of a successfully-calculated offset project whose credits license emissions elsewhere is designed to be zero or thereabouts (small margins of error are sometimes included in the calculations), such findings constitute further evidence that offset projects are having a net negative effect on climate change mitigation, provoking perpetual unease among carbon traders mindful of the history of previous market bubbles. Yet, as in the financial sector, there are powerful incentives to keep the problem covered up. Many market proponents admit that ‘measuring or even defining savings that are additional to those that would have occurred in the absence of emissions credits’ is an ‘impossibility’<sup>166</sup> only to withdraw the judgement later. Similarly, panellists at conferences on carbon trading who admit in the corridors that it is possible to show the additionality of nearly any project often chastise colleagues for saying so in public.<sup>167</sup> ‘I guess in many ways it’s akin to subprime,’ Marc Stuart of EcoSecurities confessed to *The Wall Street Journal* in the wake of his firm’s first stock crash. ‘You keep layering on crap until you say, “We can’t do this anymore.”’<sup>168</sup>

Closely tied to offset accounting's suppression of unknowns is its suppression of alternative political approaches to climate change. This takes place in the first instance at the conceptual level. Carbon offset accounting necessarily frames the political question of what would have happened without carbon projects as matter of technical prediction in a deterministic system, while at the same time framing project proponents non-deterministically, as free decision-makers whose carbon initiatives 'make a difference'. Some of the first observers to call attention to this contradiction were Minas Gerais, Brazil social activists critical of the attempt of a local charcoal and pig iron company, Plantar, to get carbon credits for the environmentally-destructive eucalyptus plantations it had established on occupied land. Of the carbon accounting deployed by the company, the activists observed: 'The argument that producing pig iron from charcoal is less bad than producing it from coal is a sinister strategy ... What we really need are investments in clean energies that at the same time contribute to the cultural, social and economic well-being of local populations.<sup>169</sup>In a later letter to Kyoto regulators, the activists, after insisting that 'the claim that without carbon credits Plantar ... would have switched to coal as an energy source is absurd,' went on to characterize the accounting procedure as a 'threat': 'It is comparable to loggers demanding money, otherwise they will cut down trees ... [the Clean Development Mechanism] should not be allowed to be used by the tree plantation industry to help finance its unsustainable practices.'<sup>170</sup> For the activists, carbon accounting's suppression of knowledge of the plurality of choices amounted to an attempt to block popular pathways to an alternative future.

The destruction of knowledge, or cultivation of ignorance, often plays out in a brutally physical way. One example comes from the Bhilangana river in Uttaranchal, India, near the village of Sarona. There, Swasti Power Engineering Ltd. is benefiting from Kyoto carbon market money in its development of a 22.5 megawatt run-of-the-river hydroelectric project that would devastate local farmers' finely-tuned (and extremely low-carbon) customary terraced irrigation system that provides them with rice, wheat, mustard, fruits and vegetables. A survey for the project conducted over ten years ago reported that there were no villages near the project; Sarona residents were never consulted and first learned about the project only in 2003, when construction machines arrived. Older women in the village led the first actions of opposition, and in March 2005, 120 villagers were jailed for four days, and another 79 arrested in July. In November 2006, at least 29 people were arrested and forced to sign a document that they would cease resistance. In police raids since, people have had their clothes torn off and been beaten, and women in the village have been assaulted, dragged by their hair and tortured.<sup>171</sup> In the mountainous river valleys of Uttaranchal, some 146 such dam projects are proposed or underway, and hundreds of hydroelectric schemes elsewhere in China, Brazil and elsewhere are also seeking carbon finance. Many are likely, as at Sarona, to contribute to the undermining of existing knowledge of low-carbon approaches to livelihood that are certain to be increasingly important to a fossil-free future. More generally, thousands of offset projects of every kind remain unknown to a wider public or even to environmentalists with a special interest in climate.<sup>172</sup>

It would be technically impossible for market calculations of carbon gained and lost to take account of the extent to which such offset projects undermine the raw materials for climate solutions; or, for that matter, the other 'opportunity costs' generated by the carbon markets, including the incalculable climatic impacts of the

markets' disincentivizing of structural change in the industrial North. Yet, to borrow Bookstaber's words on the financial markets, these costs constitute 'externalities for the entire ... system that are hard to measure but dominate their apparent value.' This is one of the ways in which what George Soros classifies as a problem of 'reflexivity' – militating against equilibrium in financial markets – also applies to carbon offset markets. Another is the way in which baseline accounting procedures set up perverse incentives for credit seekers (including host governments, credit buyers and consultant validators seeking future contracts) not only to postulate but also to bring about 'business as usual' scenarios which are the highest-emitting possible, in order to make the proposed projects appear to be saving as much carbon as possible.<sup>173</sup> For example, in many countries hosting Kyoto Protocol offset projects, the Kyoto market is creating incentives for emissions-related environmental laws not to be enforced, since the greater the 'baseline' emissions, the greater the payoffs that can be derived from carbon projects.<sup>174</sup> This trend also blurs the distinction between price incentives and prohibitions enshrined in legal codes, and thus tends to commensurate legality and 'efficiency' by normalizing the expectation that certain laws will be obeyed only if it becomes possible to earn carbon credits by doing so. Logically, that entails incessant recalculation of the baseline and continual alteration in the number of credits calculated; unlike traditional insurers, carbon traders cannot police 'gaming' in order to channel the real world into conformity to the equations. Kyoto carbon market accounting, in other words, like certain aspects of financial engineering, undermines its own stability.

As in the risk markets, the transformation of global warming into a problem of capital management has been accompanied and reinforced by erosion of the concept of conflict of interest, as criteria used to gauge the effectiveness of climate mitigation policy are increasingly influenced by private carbon consultants, big permit buyers, bankers and fund managers. Barclays Capital, a major investor in the carbon markets, boasts openly that 'two of our team are members of the Methodology Panel to the Clean Development Mechanism (CDM) Executive Board', part of the UN carbon market's regulatory body,<sup>175</sup> of which Lex de Jonge, head of the carbon offset purchase programme of the Dutch government, is the vice chair.<sup>176</sup> Like credit ratings firms in the financial markets, private sector carbon auditors approved by the UN have a strong interest in gaining future contracts from the companies that hire them; unsurprisingly, they wave through an overwhelming majority of projects under review.<sup>177</sup> In addition, the World Bank, as mentioned above, benefits from financing fossil fuel development at the same time it profits from running carbon funds that are claimed to be able to help clean up the resulting mess.<sup>178</sup> Within the insular, tightly-knit climate mitigation community, moreover, experts are constantly passing through revolving doors between private carbon trading consultancies, government, the UN, the World Bank, environmental organizations, official panels, trade associations and energy corporations. James Cameron, an environmental lawyer who helped negotiate the Kyoto Protocol, now benefits from the market he helped create in his position as Vice Chairman of Climate Change Capital, a boutique merchant bank that also boasts as staff members Kate Hampton, former climate chief at Friends of the Earth, and Jon Sohn, formerly of World Resources Institute. Henry Derwent, a former director of international climate change at the UK's Department for Environment, Food and Rural Affairs, who was responsible for domestic and European climate change policies, is now president and chief executive of the International Emissions Trading Association, an industry alliance. Sir Nicholas Stern, author of the British

government's Stern Report on Climate Change, has meanwhile championed the initiative of his private firm, IDEACarbon, to set up a carbon credit ratings agency – which will be subject to the same type of conflict of interest that earlier afflicted Moody's and other credit ratings agencies that depended for their income on the companies whose products they are rating.<sup>179</sup> As one principal of a carbon asset management firm who is also a member of the UN's CDM methodology panel noted at an industry meeting in London in October 2008, 'I helped set the rules; now my firm plays by those rules.'<sup>180</sup> European Commission coordinator for carbon markets and energy policy Peter Zapfel, a disciple of US economist-advocates of pollution trading and an instrumental figure in convincing European bureaucrats and governments to commit themselves to carbon trading,<sup>181</sup> has urged 'cross-fertilization between regulators and regulated'.<sup>182</sup> 'I don't see us as police,' the chair of the CDM Executive Board confirmed in 2007.<sup>183</sup> In the unregulated 'voluntary' markets for carbon credits, where buyers seek credits for reasons other than legal compliance, Alan Greenspan and Robert Rubin's concept of 'private regulation' is even more deeply entrenched. Laurent Segalen, formerly a carbon trading manager at the failed Lehman Brothers investment bank, expressed a wide consensus when he affirmed that 'traders should be the ones designing and determining the standards.'<sup>184</sup> As in the finance sector, however, the erosion of the concept of conflict of interest is less a cause of the carbon market's problems than a symptom of broader trends; regulation against conflict of interest would, by itself, only begin to touch the underlying issues.

Several additional parallels between financial markets' commodification of certainty/uncertainty and carbon markets' commodification of climate benefits/disbenefits also deserve emphasis in closing:

- Both markets have been legitimated by claims of 'efficiency' but undermined by their tendency to exacerbate crisis.
- As 'climate benefits' have become abstract and objectified, finance has moved in particularly to dominate that segment of the carbon offset market whose products are easiest to calculate, but which are arguably of least value to climate change mitigation – HFC and N<sub>2</sub>O projects, coal mine methane, landfill gas, and so forth. All are projects with no clear benefits for the type of systemic social and infrastructure transformation associated with the political project of phasing out fossil fuels, which of course would be extremely hard to quantify or 'objectify' into discrete tradable units. The parallel with financial engineering is clear. The more the drive to make everything calculable is indulged, the more systemic instability tends to rear its head.
- The stupendous complexity of new financial instruments such as collateralised debt obligations (CDOs) is in some ways matched by that of carbon trading, with its reams of additionality calculations, diversity of carbon credits, daunting monitoring and legal requirements and crowd of acronyms. In addition, there is a good deal of direct overlap. Carbon options have been used since 2005 and there are now swaps between Clean Development Mechanism credits and EU allowances, allowing more liquidity and larger positions. Proposals to securitize carbon credits (as a new 'asset class') have been made at least since 2007,<sup>185</sup> and EcoSecurities invented a CDO-type instrument for carbon in 2008.

- The resulting obscurity of carbon trading, like that of trading in the new financial instruments, functions politically to hide hazards from the public and even from many market players.<sup>186</sup>
- Carbon markets are different, however, in that their dangers have been further concealed by middle-class environmentalist advocacy of the Kyoto Protocol and EU ETS. Eager to defend and reform officially-sanctioned mechanisms that promised globally-coordinated action on climate change action, members of the Climate Action Network, the major group of environmentalist campaigners on global warming worldwide, hastened to ridicule critical research on inequalities in carbon market structure as ‘ideological claptrap’ and for many years strenuously denied even that carbon markets involved asset creation.<sup>187</sup> As late as October 2008, Stefan Singer, a senior European climate officer with the World Wide Fund for Nature, which backs carbon markets, was quoted at a carbon trading panel fretting that ‘it was never the intention [of the EU ETS] to create profits,’ prompting Louis Redshaw of Barclays Capital to remind him gently: ‘it’s inevitable if you institute a trading system.’<sup>188</sup>
- The endemic failure of financial-sector quantism to grasp the potential large impacts of various unknowns on price movements, take account of the on-the-ground realities of mortgage holders in low-income neighbourhoods of US cities, or give weight to well-tried ‘commons’ conceptions of ‘safety first’ is mirrored by the inability of carbon-sector quantism to achieve contact either with climatic uncertainties or the social or biophysical realities of carbon offset projects. In both cases, second-order ignorance exacerbates the dangers: isolated by background and by their location in financial districts, quants tend not to be aware that they are not aware. In 2008, for example, Richard Sandor of the Chicago Commodities Exchange was quoted approvingly in *The New Yorker* magazine endorsing schemes to commodify native forests in the global South for use as marketable sinks for industrial carbon dioxide. ‘They are slashing and burning and cutting the forests of the world. It may be a quarter of global warming and we can get the rate to two per cent simply by inventing a preservation credit and making that forest have value in other ways. Who loses when we do that?’<sup>189</sup> The neocolonialist misconceptions about forest destruction and forest politics that this confident statement exemplifies have been thoroughly discredited in thousands of scholarly publications over the last two to three decades,<sup>190</sup> and the implications often drawn for carbon accounting. Yet the statement is characteristic of quantism in both financial and carbon markets. Ignorance and destruction of various classes of knowledge has become functional and structural, not accidental, in ways that not even the 1920s critics of finance might have foreseen.

## Conclusion

Banks seeking new avenues for profit following the decline of traditional opportunities, corporations facing the uncertainties of globalization and seeking new ways to move goods: both helped make possible the age of financialization. The

consequences included using securitized debt to move money; pushing loans on customers unlikely to be able to pay them back while attempting to offload uncertainty through financial engineering, thus merging lending and insurance with an unprecedented form of gambling; helping blow asset bubbles to huge sizes; jacking up leverage to new heights; expanding credit to a US whose debt was already enormous. In the end, such initiatives were unsustainable in that they presupposed a scheme of domestication and simplification of the future that could not be fully executed. The vulnerability to unknowns and breakdowns in trust was too great. A generation of quants encouraged to promote ways of taking positions ‘against every possible state of nature’ had little motivation to stay in touch either with vernacular, safety-first conceptions of livelihood or with intellectuals’ cautions against a cascading ‘technical-fix’ approach to unknowns. Partly because public discourse on regulation has paid little attention to these aspects of the financial crisis, official responses to pressures to protect society from the new finance are likely to be confused and to exacerbate instabilities.

As financialization gained momentum in the 1990s, governments and financial and energy interests facing potential popular unrest due to a deepening climate crisis were encouraged to rely on quants to develop a ‘commodity’ solution to global warming as well. That entailed identifying climate solutions with a progressive series of quantified, discrete emissions reductions; misreading climate science; disembedding solutions from path dependence, history and politics; abstracting from how and where reductions are made to maximize efficiency; commensurating risk, uncertainty, ignorance and indeterminacy for further ‘efficiency’ gains through carbon offsets; re-embedding ‘climate benefits’ and ‘pollution rights’ in quantism, neoclassical economic theory, neoliberal policy and private enterprise; and enclosing and privatizing global carbon-cycling capacity. As in finance, commodity formation abstracted from systemic problems, in the end heightening them.

The obscure nature of both markets has so far hobbled efforts to regulate or transform either in the interests of society as a whole. The efficient markets hypothesis, the assertion that any type of uncertainty or climate benefit whatever can be safely and thoroughly commodified: no evaluation of such claims ever appears in regulatory discourse. It is seldom considered whether financial markets should in fact ‘include every financial instrument that can be dreamed up,’<sup>191</sup> whether they should continue to try to achieve maximum speed and liquidity, or whether making them more ‘transparent’ or less prone to conflicts of interest will necessarily by themselves reduce the dangers they pose. Instead of focusing attention on other sectors of society,<sup>192</sup> the US and UK governments, mistaking the recent inventions of financial engineers for the foundation of livelihood in industrialized societies, have funnelled large quantities of public cash to many major financial institutions while giving them few new incentives to be responsive to public concerns or learn from the failures of the preceding 30 years’ efforts at radical simplification of an unsimplifiable future.

Meanwhile, businesses nervous about carbon bubbles and ‘carbon cowboys’ (to cite the headline of a *Financial Times* series),<sup>193</sup> together with environmentalists and UN bureaucrats troubled by ‘unsustainability’ or ‘nonadditionality’ in carbon projects, have erected or urged offset standards of many kinds. In doing so, they have generally failed to comprehend that efforts to distinguish between ‘gourmet’ or ‘gold standard’ carbon and ‘subprime’ carbon are hampered by the irremediably problematic

relationship between reductions and offsets, as well as that between the climate crisis and the underlier ('emissions reductions'). The question of whether the carbon markets are regulatable or not remains politically incorrect even after a decade of failure. Rather than entertaining the question, the British state is, as mentioned above, even intervening to attempt to ensure the stability of carbon prices in a way that directly undermines investment in low-carbon infrastructure. Environmentalists, too, have on the whole failed to learn from the financial crisis that not all aspects of all markets will automatically be susceptible to correction through belated official oversight and control. Indeed, carbon markets, where both commodity and scarcity are created by lobby-vulnerable legislators alone, are even more certain to outrun any good intentions entertained by their inventors and reformers than the new derivatives markets were. Meanwhile, the disjuncture between the global warming problem and the climate commodity is storing up a problem of asset valuation that is likely to end in another crash even before one or another projected climate catastrophe strikes, particularly if a speculative carbon bubble encourages headlong development of unverifiable carbon assets.

Stressing the limitations of stereotyped responses to crisis, this article has tried to suggest that comparative study of the financial and carbon markets can inform constructive progressive responses to a new era of turbulence. Financial crisis, climate crisis: each can perhaps help teach what needs to be avoided when contending with the other.

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## NOTES

- <sup>1</sup> “‘Everyone Needs to Rethink Everything’”: Reflections from the IMF’s Former Chief Economist’, interview with Simon Johnson, *Multinational Monitor*, Vol. 29, No. 3 (November/December 2008), pp. 39-43, p. 42. I owe many of the ideas in this article to Nick Hildyard, Sarah Sexton and Michelle Chan, although they might not all agree with all of its conclusions.
- <sup>2</sup> Editorial, *Environmental Data Services Report* 354, July 2004, p. 3.
- <sup>3</sup> See, for example, the Beijing Declaration of 15 October 2008: <http://focusweb.org/the-global-economic-crisis-an-historic-opportunity-for-transformation.html?Itemid=92>.
- <sup>4</sup> Hazel Henderson, ‘Reforming Global Finance: Re-Designing Money Systems to Reduce Greenhouse Gas Emissions and Accelerate the Growing Green Economy’, presentation to the Green Economy Initiative Conference, United Nations Environment Programme, Geneva, 1 December 2008, <http://www.ethicalmarkets.com/?p=1119>.
- <sup>5</sup> ‘Declaration of Maputo’, 5th International Conference of La Via Campesina, Maputo, Mozambique, 19-22 October 2008, [http://www.worldproutassembly.org/archives/2008/11/declaration\\_of\\_4.html](http://www.worldproutassembly.org/archives/2008/11/declaration_of_4.html).
- <sup>6</sup> Martin Khor, ‘Spend the Trillions on Climate’, Third World Network, December 15, 2008, <http://banglapraxis.wordpress.com/2008/12/15/spend-the-trillions-on-climate/>.
- <sup>7</sup> Ramesh Jura, ‘And Now a New Green Deal?’, Inter Press Service, 12 December 2008.
- <sup>8</sup> Andrei Marcu, ‘Risks and Opportunities in Global Carbon Markets’, Carbon Markets 2008 Conference, London, 8-10 October 2008; Marc Gunther, ‘Cooking up Carbon Credits’, *Fortune*, August 2008.
- <sup>9</sup> James Kanter, ‘Carbon Trading: Where Greed is Green,’ *International Herald Tribune*, 20 June 2007; Fiona Harvey, ‘Carbon Trading Set to Dominate Commodities’, *Financial Times*, 26 June 2008.
- <sup>10</sup> Kanter, James, ‘In London’s Financial World, Carbon Trading Is the New Big Thing’, *New York Times*, 6 July 2007.
- <sup>11</sup> Murray Coleman, ‘Second Carbon Exchange-Traded Product Makes It to Market’, *Index Universe*, 15 December 2008.
- <sup>12</sup> Karl Polanyi, *The Great Transformation* (Beacon Press, 2001 [1944]).
- <sup>13</sup> See, for example, John Bellamy Foster, ‘The Financialization of Capital and the Crisis’, *Monthly Review*, April 2008 and Thomas I. Palley, ‘Financialization: What It Is and Why It Matters,’ *Working Paper Series*, No. 153, Political Economy Research Institute, University of Massachusetts, November 2007.
- <sup>14</sup> G. A. Epstein (ed), *Financialization and the World Economy* (Edward Elgar, 2005), p. 3.
- <sup>15</sup> Ben Fine, ‘Looking at the Crisis through Marx: Or Is It the Other Way about?’, ms., 2008.
- <sup>16</sup> Robin Blackburn, ‘Finance and the Fourth Dimension’, *New Left Review* 39, May/June 2006.
- <sup>17</sup> Greta Krippner, ‘Accumulation and the Profits of Finance’, in Ismail Erturk, Julie Froud, Sukhdev Johal, Adam Leaver & Karel Williams (eds), *Financialization At Work: Key Texts and Commentary* (Routledge, 2008), p. 195.
- <sup>18</sup> Martin Wolf, “Why It Is so Hard to Keep the Financial Sector Caged”, *Financial Times*, 6 February 2008.
- Financial profits as a percentage of total profits increased (Foster).
- <sup>19</sup> Blackburn, ‘Finance and the Fourth Dimension’.
- <sup>20</sup> Krippner, ‘Accumulation’, p. 195.
- <sup>21</sup> Erturk et al., ‘Introduction’, *Financialization*, p. 12.
- <sup>22</sup> Bank of International Settlements, *Quarterly Review*, December 2008, statistical annex, p. A103.
- <sup>23</sup> Bank of International Settlements, *Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity in 2007 – Final results*, p. 3; International Monetary Fund, *World Economic Outlook*, October 2007.
- <sup>24</sup> Keith Hart, *Money in an Age of Inequality* (Texere, 2001), pp. 161-2.

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<sup>25</sup> Banks assembled high-risk and lower-risk mortgages into tranching asset-backed securities that were then bought, re-bundled and re-sold in batches with different risk ratings. Credit default swaps were used to hedge lower-risk tranches. When it became clear that many mortgages were bad, and that counterparties could not redeem the credit default swaps, some banks stuck with bad assets went bankrupt, and banks became reluctant to lend to each other, knocking the props out from under the construction known as ‘economic growth’. Losses to the US economy, one economist estimates, could amount to \$1.6 trillion (*Washington Post*, 16 December 2008). Millions of jobs have been lost in North America, Europe and the Far East, and Latin American countries have lost most access to external finance. (Andrew Taylor & Alan Beattie, ‘Human Cost Rises as Gloom Deepens’ and Stephen Fidler, ‘Going South’, *Financial Times*, 9 January 2009.

<sup>26</sup> Michel Callon (ed), *The Laws of the Markets* (Blackwell, 1998).

<sup>27</sup> Polanyi, *Great Transformation*, p. 76.

<sup>28</sup> Dick Bryan & Michael Rafferty, ‘Financial Derivatives and the Theory of Money’, *Economy and Society*, Vol. 36, No. 1, 2007, pp. 134-158, p. 136.

<sup>29</sup> Alfred Steinherr, *Derivatives: The Wild Beast of Finance* (Wiley, 1998), p. 101, quoted in Edward LiPuma & Benjamin Lee, *Financial Derivatives and the Globalization of Risk* (Duke, 2004), p. 81.

<sup>30</sup> J. D. A. Wiseman, *Pricing Money: A Beginner’s Guide to Money, Bonds, Futures and Swaps* (Wiley, 2001), p. 101.

<sup>31</sup> R. H. Tawney, ‘Against the Rentier and Financier’, in Erturk et al., *Financialization at Work*, p. 57.

<sup>32</sup> J. M. Keynes, ‘Speculation, Cyclicity and the Euthanasia of the Rentier’, in Erturk et al., *op. cit.*

<sup>33</sup> Richard Bookstaber, *A Demon of Our Own Design: Markets, Hedge Funds and the Perils of Financial Innovation* (Wiley, 2007).

<sup>34</sup> Jean-Philippe Bouchaud, ‘Economics Needs a Scientific Revolution’, *Nature*, Vol. 455 (2008), p. 1181.

<sup>35</sup> Nassim Nicholas Taleb, *The Black Swan* (Random House, 2007).

<sup>36</sup> Stephen Gudeman, ‘Watching Wall Street’, *Anthropology Today*, Vol. 24, No. 6, p. 20.

<sup>37</sup> As Viviana Zelizer documents, life insurance was widely frowned upon for moral reasons in earlier eras – a type of restriction that prefigured its current ‘embedding’: *Morals and Markets: The Development of Life Insurance in the United States* (Transaction, 1983).

<sup>38</sup> Stephen Gudeman, *Economy’s Tension: The Dialectics of Community and Market* (Berghahn, 2008), p. 141.

<sup>39</sup> Frank Knight, *Risk, Uncertainty and Profit* (Houghton Mifflin, 1921).

<sup>40</sup> Matthew Philips, ‘The Monster that Ate Wall Street,’ *Newsweek*, 6 October 2008: “For example, Lehman Brothers had itself made more than \$700 billion worth of swaps, and many of them were backed by AIG. And when mortgage-backed securities started going bad, AIG had to make good on billions of dollars of credit default swaps. Soon it became clear it wasn’t going to be able to cover its losses ... The reason the federal government stepped in and bailed out AIG was that the insurer was something of a last backstop in the CDS market. While banks and hedge funds were playing both sides of the CDS business—buying and trading them and thus offsetting whatever losses they took—AIG was simply providing the swaps and holding onto them. Had it been allowed to default, everyone who’d bought a CDS contract from the company would have suffered huge losses in the value of the insurance contracts they had purchased, causing them their own credit problems.”

<sup>41</sup> A. Michael Spence, ‘Lessons from the Crisis,’ PIMCO, November 2008, <http://www.pimco.com/LeftNav/Viewpoints/2008/Viewpoints+Lessons+from+the+Crisis+Spence+November+2008.htm>.

<sup>42</sup> LiPuma & Lee, *Financial Derivatives*, pp. 20-21.

<sup>43</sup> Bryan & Rafferty, ‘Financial Derivatives and the Theory of Money’, p. 140.

<sup>44</sup> Michael Pryke, ‘Geomoney: An Option on Frost, Going Long on Clouds’, *Geoforum*, Vol. 38 (2007), pp. 576-588, p. 583.

- <sup>45</sup> LiPuma & Lee, *Financial Derivatives*, p. 21.
- <sup>46</sup> *Ibid.*, pp. 21-22, 38.
- <sup>47</sup> J. D. Agarwal & A. Agarwal, 'Savings Concept in Derivative Instruments', Paper presented to the 7th International Conference of International Society for Intercommunication of New Ideas, 'Frontiers in Finance', 23 August 2003, <http://nt2.fas.nus.edu.sg/ecs/res/seminar-papers/22%20Sep%2003.pdf> and Shigeyuki Hamori, Naoko Hamori & David A. Anderson, 'An Empirical Analysis of the Efficiency of the Osaka Rice Market During Japan's Tokugawa Era', *Journal of Futures Markets*, Vol. 21, No. 9, pp. 861-874.
- <sup>48</sup> A. R. Bell, C. Brooks, & P. Dryburgh, 'Interest Rates and Efficiency in Medieval Wool Forward Contracts', *Journal of Banking & Finance*, Vol. 31, No. 2 (2007), pp. 361-380, [http://www.sciencedirect.com/science?\\_ob=ArticleURL&\\_udi=B6VCY-4KGG1PN-1&\\_user=10&\\_rdoc=1&\\_fmt=&\\_orig=search&\\_sort=d&view=c&\\_acct=C000050221&\\_version=1&\\_urlVersion=0&\\_userid=10&md5=8c824d3be7235cec53bc5c8273458a90](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VCY-4KGG1PN-1&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=8c824d3be7235cec53bc5c8273458a90).
- <sup>49</sup> M. Levinson, *Guide to Financial Markets* (Financial Times/Profile Books, 2005), p. 167.
- <sup>50</sup> 'Farmers Teach Wall Street Futures', Wesels Living History Farm, [http://www.livinghistoryfarm.org/farminginthe50s/money\\_12.html](http://www.livinghistoryfarm.org/farminginthe50s/money_12.html).
- <sup>51</sup> Nasser Saber, 'Speculative Capital: The Upper Hand', *Institutional Investor's Alpha*, July/August 2007, p. 41, <http://www.alphamagazine.com/article.aspx?articleID=1396902>.
- <sup>52</sup> Callon's famous riposte to Polanyi is that rather than becoming 'disembedded' from society, in fact 'the economy is embedded in economics'. This insight has been brilliantly elaborated by Timothy Mitchell, who argues that instead of being a creation of the 18<sup>th</sup> or early 19<sup>th</sup> century, 'the economy' only emerged in the 1930s and 1940s, 'reflecting the collapse of a colonial organization of power, knowledge and exchange, and the rise of the national state as producer of statistical knowledge and custodian of the economic.' See Timothy Mitchell, *Rule of Experts: Egypt, Techno-Politics, Modernity*, (University of California Press, 2002), p. 246.
- <sup>53</sup> Nassim Taleb astutely points out that no matter how much social landscaping they do, casinos still cannot prevent black swans from popping up in the form of, say, disgruntled employees trying to blow up the building – often with financial results far greater than any of those that their elaborate 'risk management' systems are designed to protect against: *Black Swan*, pp. 126-32.
- <sup>54</sup> See Donald MacKenzie, Fabian Muniesa & Lucia Siu (eds) *Do Economists Make Markets? On the Performativity of Economics* (Princeton, 2008); Donald MacKenzie, *Material Markets: How Economic Agents are Constructed* (Oxford University Press, 2009).
- <sup>55</sup> Boris Holzer & Yuval Millo, 'From Risks to Second-Order Dangers in Financial Markets: Unintended Consequences of Risk-Management Systems', *New Political Economy*, Vol. 10, No. 2, 2005; Gillian Tett, 'Volatility Wrecks Financial World's Value at Risk Models', *Financial Times*, 12 October 2007; Robin Blackburn, 'The Subprime Crisis', *New Left Review*, No. 50 (2008), 63-106, pp. 89-90.
- <sup>56</sup> Donald MacKenzie, 'An Equation and its Worlds: Bricolage, Exemplars, Disunity and Performativity in Financial Economics', *Social Studies of Science*, Vol. 33, No. 6 (2003), pp. 831-868, p. 836.
- <sup>57</sup> Donald MacKenzie, *An Engine, Not a Camera: How Financial Models Shape Markets* (Massachusetts Institute of Technology Press, 2006), p. 144. When first proposed, in the late 1960s, the idea of an options exchange idea faced considerable hostility from established traders and officials at the US Securities and Exchange Commission, the then chairman comparing options to 'marijuana and Thalidomide'.
- <sup>58</sup> *Ibid.*, p. 142.
- <sup>59</sup> *Ibid.*, p. 148.
- <sup>60</sup> *Ibid.*, p. 149.
- <sup>61</sup> Even when the International Monetary Market was finally set up, Melamed had to act as 'a one-man enforcer' to get his associates to use it. It 'takes planning, calculation, arm-twisting, and tenacity to get a market up and going,' Melamed admitted. 'Even when it's chugging along, it has to be cracked and pushed.' *Ibid.*, p. 173. As elsewhere, fields for *Homo*

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- economicus* to play on have to be constructed by beings belonging to another species. Compare Carol Rose, 'Property as Storytelling: Perspectives from Game Theory, Narrative Theory, Feminist Theory', *Yale Journal of Law and the Humanities*, Vol. 2 (1990).
- <sup>62</sup> Donald Mackenzie, 'Is Economics Performative? Option Theory and the Construction of Derivatives Markets', paper presented to the annual meeting of the History of Economics Society, Tacoma, WA, 25 June 2005, p. 18.
- <sup>63</sup> 'Interview with Nomi Prins', *Multinational Monitor*, Vol. 29, No. 3 (November/December 2008), p. 50.
- <sup>64</sup> Bryan & Rafferty, 'Financial Derivatives and the Theory of Money', p. 35. Helping derivatives mix the characteristics of a range of different assets in one product is their lack of connection to ownership of the underlying assets to which the derivative relates.
- <sup>65</sup> Bookstaber, *A Devil of Our Own Design*, pp. 233 ff.
- <sup>66</sup> Randy Martin, 'The Financialization of Everyday Life' in Erturk, et al., *Financialization at Work*, p. 252.
- <sup>67</sup> Quoted in Richard Swedberg, 'Conflicts of Interest in the US Brokerage Industry', in Karen Knorr Cetina & Alex Preda, *The Sociology of Financial Markets* (Blackwell, 2005), 187-203, p. 189.
- <sup>68</sup> Frank Partnoy, *Infectious Greed: How Deceit and Risk Corrupted the Financial Markets* (Times Books, 2003). One 2006 internal email from Standard & Poor's stated that 'Rating agencies continue to create and [sic] even bigger monster — the CDO [collateralized debt obligation] market. Let's hope we are all wealthy and retired by the time this house of cards falters' (Bloomberg, 'Moody's, S&P Employees Doubted Ratings, E-Mails Say', Bloomberg, 22 October 2008).
- <sup>69</sup> Blackburn, 'Finance and the Fourth Dimension'.
- <sup>70</sup> Bouchaud, 'Economics Needs a Scientific Revolution'.
- <sup>71</sup> Value-at-Risk, Taleb and fellow trader Pablo Triana claim, 'was to blame for the crisis': 'When you see a quantitative "expert", shout for help, call for his disgrace, make him accountable. Do not let him hide behind the diffusion of responsibility. Ask for the drastic overhaul of business schools ... Ask for the Nobel prize in economics to be withdrawn from the authors of these theories ... Remove Value-at-Risk books from the shelves – quickly. Do not be afraid for your reputation. Please act now. Do not just walk by' (*Financial Times*, 7 December 2008).
- <sup>72</sup> Satyajit Das, *Traders, Guns and Money: Knowns and Unknowns in the Dazzling World of Derivatives* (Financial Times/Prentice Hall, 2006), p. 177.
- <sup>73</sup> George Soros, *The New Paradigm for Financial Markets: The Credit Crisis of 2008 and What It Means* (Public Affairs, 2008).
- <sup>74</sup> Bookstaber, *Devil of our Own Design*.
- <sup>75</sup> 'The Holes in Black-Scholes,' *Risk*, Vol. 1, No. 4 (1988), pp. 30-33; 'How to Use the Holes in Black-Scholes', *Journal of Applied Corporate Finance*, Vol. 1, No. 4 (1989), pp. 67-73.
- <sup>76</sup> Perry Mehrling, *Fischer Black and the Revolutionary Idea of Finance* (Wiley, 2005), p. 291.
- <sup>77</sup> James C. Scott's seminal *Seeing like a State* (Yale University Press, 1999), although it focuses on the 'high modernism' of 20<sup>th</sup>-century states rather than on financial or other markets, is the crucial reference on simplification in the sense used here.
- <sup>78</sup> See Ricardo Carrere & Larry Lohmann, *Pulping the South: Industrial Tree Plantations and the World Paper Economy* (Zed, 1996).
- <sup>79</sup> Espen Gaarder Haug & Nassim Nicholas Taleb, 'Why We Have Never Used the Black-Scholes-Merton Option Pricing Formula' (fourth version), January 2008, <http://ssrn.com/abstract=1012075>.
- <sup>80</sup> Mitchell, *Rule of Experts*.
- <sup>81</sup> Larry Lohmann, 'Toward a Different Debate in Environmental Accounting: The Cases of Carbon and Cost-Benefit', *Accounting, Organizations and Society*, forthcoming 2009.
- <sup>82</sup> Erturk et al., *Financialization*, p. 13.

- <sup>83</sup> Jeff Goodell, 'Capital Pollution Solution?', *New York Times Magazine*, 30 July 2006.
- <sup>84</sup> Sandor, Richard L. & Howard B. Sosin, 'Inventive Activity in Futures Markets: A Case Study of the Development of the First Interest Rate Futures Market' in Manfred E. Streit (ed), *Futures Markets: Modeling, Managing and Monitoring Futures Trading* (Blackwell, 1983), pp. 255-272.
- <sup>85</sup> Robert O'Harrow Jr. & Brady Dennis, 'The Beautiful Machine', *Washington Post*, 29 December 2008.
- <sup>86</sup> See, for instance, <http://terraglobalcapital.com/About.htm>.
- <sup>87</sup> Janet Redman, *World Bank: Climate Profiteer* (Institute for Policy Studies, 2008).
- <sup>88</sup> Caisse des Depots, 'Carbon Investment Funds: The Influx of Private Capital', November 2007, [http://www.caissedesdepots.fr/IMG/pdf\\_07-11\\_Mission\\_Climat\\_Research\\_Report\\_12\\_Carbon\\_Investment\\_Funds-2.pdf](http://www.caissedesdepots.fr/IMG/pdf_07-11_Mission_Climat_Research_Report_12_Carbon_Investment_Funds-2.pdf).
- <sup>89</sup> Larry Lohmann, 'Marketing and Making Carbon Dumps: Commodification, Calculation and Counterfactuals in Climate Change Mitigation', *Science as Culture*, Vol. 14, No. 3 (2005), pp. 203-235; *Carbon Trading: A Critical Conversation on Climate Change, Privatization and Power* (Dag Hammarskjold Foundation, 2006).
- <sup>90</sup> Donald MacKenzie, 'Making Things the Same: Gases, Emission Rights and the Politics of Carbon Markets', *Accounting, Organizations and Society*, forthcoming 2009.
- <sup>91</sup> See, for example, "'Even at a conceptual stage indigenous peoples should be involved": Interview with Victoria Tauli-Corpuz', *REDD-Monitor*, January 2009, <http://www.redd-monitor.org/2009/01/13/even-at-a-conceptual-stage-indigenous-peoples-should-be-involved-interview-with-victoria-tauli-corpuz/>.
- <sup>92</sup> Steffen Kalbekken and Nathan Rive, 'Why Delaying Climate Action is a Gamble', Centre for International Climate and Environmental Research, 2005, [http://www.stabilisation2005.com/30\\_Steffen\\_Kalbekken.pdf](http://www.stabilisation2005.com/30_Steffen_Kalbekken.pdf).
- <sup>93</sup> See, for example, Leo Panitch and Colin Leys, *Coming to Terms with Nature*, Socialist Register 2007.
- <sup>94</sup> W. Brian Arthur, *Increasing Returns and Path Dependence in the Economy* (Cambridge University Press, 1999).
- <sup>95</sup> Gregory C. Unruh, 'Understanding Carbon Lock-In', *Energy Policy*, Vol. 28 (2000), pp. 817-30.
- <sup>96</sup> Quoted in Mike Scott, 'Market Meltdown? Carbon Trading is just Warming up', *Independent on Sunday Business*, 27 July 2008, p. 4.
- <sup>97</sup> Lohmann, *Carbon Trading*, pp. 101-121.
- <sup>98</sup> *Ibid.*, p. 114.
- <sup>99</sup> David M. Driesen, 'Sustainable Development and Market Liberalism's Shotgun Wedding: Emissions Trading under the Kyoto Protocol', *Indiana Law Journal*, Vol. 83, No. 1 (2008), pp. 21-69, pp. 56-58. Short-term cost-effectiveness, of course, has been increasingly at a premium in the post-1970s era of financialization and 'shareholder value'; compare, for example, the account of the large US corporation in John Kenneth Galbraith, *The New Industrial Estate* (Penguin, 1968) with, say, that of Thomas O'Boyle, *At Any Cost: Jack Welch, General Electric and the Pursuit of Profit* (Vintage, 1998).
- <sup>100</sup> Gwyn Prins, & Steve Rayner, 'Time to Ditch Kyoto', *Nature*, Vol. 449, pp. 973-975, p. 974. See also [http://www.wired.com/politics/law/magazine/16-10/sl\\_rayner](http://www.wired.com/politics/law/magazine/16-10/sl_rayner).
- <sup>101</sup> Tariq Banuri & Hans Opschoor, 'Climate Change and Sustainable Development', United Nations Department of Economic and Social Affairs Working Paper No. 56, ST/ESA/2007/DWP/56, October, New York: United Nations, p. 22.
- <sup>102</sup> J. Lovell, 'Carbon Price is Poor Weapon against Climate Change', Reuters, 24 September 2007.
- <sup>103</sup> Arthur, *Increasing Returns and Path Dependence in the Economy*, p. 27. It is a historical irony that just as carbon trading was beginning to establish itself as a theoretical approach, Arthur and other economists were assembling a body of theory that contested the assumption that historical accidents and starting points were unimportant to economic outcomes, merely delivering the economy, through a series of negative feedbacks, to its inevitable equilibrium

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(p. 11). Starting points, positive feedbacks and multiple equilibria, Arthur argued, were not marginal or negligible economic phenomena, but often central. Nowhere is this more so than in responses to climate change, where ‘locking in’ new social and technological patterns has been widely agreed to be crucial to overcoming a previously ‘locked-in’ fossil fuel dependence.

<sup>104</sup> Gwyn Prins, & Steve Rayner, ‘Time to Ditch Kyoto’, *Nature*, Vol. 449, pp. 973–975, p. 974.

<sup>105</sup> Laurie Williams & Allan Zabel, ‘Climate Change Legislation – Urgent Plea for Enactment of Carbon Fees and Ban on New Coal-Fired Power Plants without Carbon Sequestration’, open letter, 4 May 2008, <http://www.carbonfees.org/home/>.

<sup>106</sup> Margaret Taylor et al., ‘Regulation as the Mother of Invention: The Case of SO<sub>2</sub> Control’, *Law and Policy*, Vol. 27 (2005), pp. 348–78.

<sup>107</sup> Curtis A. Moore, ‘Marketing Failure: The Experience with Air Pollution Trading in the United States’ (Health and Clean Air, 2003), [http://www.healthandcleanair.org/emissions/marketing\\_failure.pdf](http://www.healthandcleanair.org/emissions/marketing_failure.pdf), p. 24.

<sup>108</sup> Richard A. Liroff, *Reforming Air Pollution Regulation: The Toil and Trouble of EPA’s Bubble* (Conservation Foundation, 1986), p. 100

<sup>109</sup> United Kingdom Department for Business, Enterprise and Regulatory Reform, *UK Renewable Energy Strategy: Consultation Document 2008. Executive Summary*, (UK Stationery Office, 2008), pp. 20-1.

<sup>110</sup> ‘Leaked Note Reveals UK’s Renewables Angst’, *Environmental Data Service Europe Daily* 2373, 15 August 2007.

<sup>111</sup> Jeffrey Sachs, ‘Technological Keys to Climate Protection’, *Scientific American*, March 2008.

<sup>112</sup> Nicholas Stern, *The Economics of Climate Change: The Stern Review* (Cambridge University Press, 2007). For a less conventional perspective see Daniel Buck, ‘The Ecological Question: Can Capitalism Prevail?’ in Panitch & Leys, *Coming to Terms with Nature*, pp. 60-71.

<sup>113</sup> Lohmann, *Carbon Trading*, pp. 94-101, 187-190; Ruth Greenspan Bell, ‘Market Failure’, *Environmental Forum*, March/April 2006, pp. 28–33, <http://www.weathervane.rff.org/>, p. 28.

<sup>114</sup> Steve Rayner: ‘Take Climate Change Seriously’, *Wired*, 16 October 2008, [http://www.wired.com/politics/law/magazine/16-10/sl\\_rayner](http://www.wired.com/politics/law/magazine/16-10/sl_rayner).

<sup>115</sup> ‘Polluting EU Power Firms to Reap Billions of Euros in Windfall Profits: WWF’, *Point Carbon*, 7 April 2008.

<sup>116</sup> See, for example, Axel Michaelowa & Sonja Butzengeiger, ‘EU Emissions Trading: Navigating between Scylla and Charybdis’, *Climate Policy*, Vol. 5 (2005), pp. 3-5; Michael Grubb, Michael Azar, Christian Persoon & U. Martin, ‘Allowance Allocation in the European Emissions Trading Scheme: A Commentary’, *Climate Policy*, Vol. 5 (2005), pp. 132-33.

<sup>117</sup> I am grateful to Jane Williams of California Communities against Toxics for this information.

<sup>118</sup> Richard Toshiyuki Drury et al., ‘Pollution Trading and Environmental Injustice: Los Angeles’ Failed Experiment in Air Quality Policy’, *Duke Environmental Law and Policy Forum*, Vol. 45 (1999).

<sup>119</sup> United States Public Interest Research Group, *Pollution on the Rise: Local Trends in Power Plant Pollution* (US PIRG, 2005).

<sup>120</sup> Fossil carbon transferred above ground cannot be locked away safely underground in the form of new deposits of coal, oil or gas, or in the form of carbonate rock, for millions of years. For human purposes, therefore, any mining of fossil fuels constitutes a permanent transfer of carbon from a below-ground geological system to an above-ground system in which biotic, physical, chemical, atmospheric and surface-geological processes interact. As biologist Tim Flannery puts it, ‘There is so much carbon buried in the world’s coal seams [alone] that, should it find its way back to the surface, it would make the planet hostile to life as we know it’ (‘Monstrous Carbuncle’, *London Review of Books*, Vol. 27, No. 1 (2005)).

<sup>121</sup> In an unstable climate system, for instance, runaway feedback effects triggered by

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obscure factors such as the reduced capacity of warming oceans to absorb carbon dioxide are capable of radically altering even such symbols of unchangeability as the Indian monsoons. In the past, climate change has often been characterized by deterministic but unpredictable (or ‘chaotic’) events and processes of extreme impact. As with similar events in the financial markets, these render problematic reliance on probabilistic bell curves and conventional ‘risk management’, which assume that individual variation averages out and no single event is capable of changing overall trends. The quantist imperative of carbon credit accounting (driven by, among other things, policy and economic theory) is to enlist scientists in helping to reduce these ‘monsters’ to (or frame them as) probabilities. Demand is strong for tidy clusters of ‘likeliest scenarios’ to feed into economic or political models, complete with ‘probabilities’ of, say, a 2 or 5 degree C temperature rise by 2100. This is necessary for credit accounting involving future biotic sequestration (Lohmann, ‘Marketing and Making Carbon Dumps’), but also for accounting for carbon outcomes more generally, and for cost–benefit analysis of action on climate change.

<sup>122</sup> Lohmann, ‘Toward a Different Debate’; Stephen H. Schneider, S. H., ‘What is ‘Dangerous’ Climate Change?’, *Nature*, vol. 411 (2001), pp. 17–19; A. Grubler & N. Nakicenovic ‘Identifying Dangers in an Uncertain Climate’, *Nature*, Vol. 412 (2001), p. 15R; J. Lempert & M. E. Schlesinger, ‘Climate-Change Strategy Needs to be Robust’, *Nature*, Vol. 412 (2001), p. 375; Daniel Sarewitz, *Frontiers of Illusion: Science, Technology and the Politics of Progress* (Temple University Press, 1996). The crash-fuelling tension in the financial markets between the imperatives of commodity calculation and the ‘safety-first’ need to accommodate unknowables is paralleled at all levels of the carbon markets. When faced with uncertainties and ignorance, for instance, carbon accountants tend to hedge their calculations toward the ‘conservative’ side by adding a more or less arbitrary margin of, say, 25 per cent, or looking for commensurable ‘hedgies’. Because events and processes of extreme impact, however unexpected, could overwhelm almost any margin or ‘hedge’ likely to be added, many small farmers and indigenous peoples, on the other hand, especially in the global South, tend where possible to value resilience and ‘safety first’ practices over probabilistic calculations of gain and loss or arbitrary, numerical ‘safety margins’ as ways of handling unknowns. See, e.g., James C. Scott, *The Moral Economy of the Peasant* (Yale University Press, 1976); E. P. Thompson, *Customs in Common: Studies in Traditional Popular Culture* (New Press, 1990) and John Berger, *Pig Earth* (Pantheon, 1979); cf. Samuel Popkin, *The Rational Peasant* (University of California Press, 1979).

<sup>123</sup> Martin L. Weitzman, ‘On Modeling and Interpreting the Economics of Catastrophic Climate Change’, REStat FINAL Version, 7 July 2008, <http://www.economics.harvard.edu/faculty/weitzman/files/REStatFINAL.pdf>: ‘Standard approaches to modeling the economics of climate change (even those that purport to treat risk by Monte Carlo simulations) very likely fail to account adequately for the implications of large impacts with small probabilities. From inductive experience alone, one cannot acquire sufficiently accurate information about the probabilities of extreme tail disasters to prevent the expected marginal utility of an extra unit of consumption from becoming infinite for any utility function with relative risk aversion everywhere bounded above zero. ... It is difficult to imagine what [temperature rises of 10 or 20 C] might mean for life on earth, but such high temperatures have not been seen for hundreds of millions of years and such a rate of change over a few centuries would be unprecedented even on a time scale of billions of years. Global average warming of 10 C- 20 C masks tremendous local and seasonal variation, which can be expected to produce temperature increases much greater than this at particular times in particular places. Because these hypothetical temperature changes would be geologically instantaneous, they would effectively destroy planet Earth as we know it. At a minimum such temperatures would trigger mass species extinctions and biosphere ecosystem disintegration matching or exceeding the immense planetary die-offs associated in Earth’s history with a handful of previous geo-environmental mega-catastrophes. There exist some truly terrifying consequences of mean temperature increases of 10 C – 20 C, such as: disintegration of the Greenland and at least the Western part of the Antarctic ice sheets with dramatic raising of

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sea level by perhaps 30 meters or so, critically-important changes in ocean heat transport systems associated with thermohaline circulations, complete disruption of weather, moisture and precipitation patterns at every planetary scale, highly consequential geographic changes in freshwater availability, regional desertification – and so forth and so on ... the more speculative and fuzzy are the tiny tail probabilities of extreme events, the less ignorable and the more serious is the impact on present discounted expected utility for a risk-averse agent.’

<sup>124</sup> Lohmann, ‘Marketing and Making’, p. 207.

<sup>125</sup> Daphne Wysham, ‘Carbon Market Fundamentalism’, *Multinational Monitor*, Vol 29, No. 3, November/December 2008.

<sup>126</sup> See, for example, Robert Hahn and Robert Stavins, ‘Trading in Greenhouse Permits: A Critical Examination of Design and Implementation Issues’, in H. Lee (ed), *Shaping National Responses to Climate Change* (Island Press, 1995), p. 203.

<sup>127</sup> Lohmann, *Carbon Trading*, p. 334.

<sup>128</sup> Curtis A. Moore, ‘Marketing Failure: The Experience with Air Pollution Trading in the United States’ (Health and Clean Air, 2003), [http://www.healthandcleanair.org/emissions/marketing\\_failure.pdf](http://www.healthandcleanair.org/emissions/marketing_failure.pdf) or [www.acidrain.org/AN2-04.htm](http://www.acidrain.org/AN2-04.htm), pp. 7-8.

<sup>129</sup> Driesen, ‘Sustainable Development’, p. 62.

<sup>130</sup> Kevin Smith, *The Carbon Neutral Myth: Offset Indulgences for your Climate Sins* (Carbon Trade Watch, 2007).

<sup>131</sup> MacKenzie, ‘Making Things the Same’.

<sup>132</sup> Lancaster, Robin, ‘Mitigating Circumstances’, *Trading Carbon*, December 2007.

<sup>133</sup> Figure reproduced from Nathalie G. Drouin & Derek West, ‘Oversight of the Montréal Climate Exchange’, presentation to the CFTC International Enforcement Meeting, Montreal, 11 June 2008.

<sup>134</sup> Point Carbon, *CDM and JI Monitor* Vol. 6, No. 1, 9 January 2008; Daniel Tanuro, ‘Fundamental Inadequacies of Carbon Trading for the Struggle against Climate Change’, March 2008, <http://climateandcapitalism.com/?p=377>.

<sup>135</sup> ‘EU on Track to Surpass Kyoto Cuts Commitments’, *ENDS Report*, November 2008, pp. 17-18; European Environmental Agency, ‘GHG Trends and Projections’, October 2008.

<sup>136</sup> *Ibid.*

<sup>137</sup> *Los Angeles Times*, 20 February 2008. In California, many renewable energy developers are “critical of cap and trade, due to the volatility and uncertainty of carbon prices under cap and trade, which they point to as unreliable when it comes to planning, developing, and financing renewable energy projects” (Jose Carmona, The Verde Group, personal communication).

<sup>138</sup> Alex Padilla, Letter to Commissioner Timothy Simon, California Public Utilities Commission, 19 February 2008.

<sup>139</sup> United Nations Environment Programme Risoe Centre on Energy, Climate and Sustainable Development, CDM Pipeline, 1 December 2008, <http://www.cdmpipeline.org/>.

<sup>140</sup> See, for example, Barbara Haya, *Failed Mechanism: How the CDM is Subsidizing Hydro Developers and Harming the Kyoto Protocol* (International Rivers, 2007), [http://www.internationalrivers.org/files/Failed\\_Mechanism\\_3.pdf](http://www.internationalrivers.org/files/Failed_Mechanism_3.pdf).

<sup>141</sup> Tamra Gilbertson, ‘The Offsets Market in India: Confronting Carbon Colonialism’, Carbon Trade Watch, [http://www.carbontradewatch.org/index.php?option=com\\_content&task=view&id=42&Itemid=45](http://www.carbontradewatch.org/index.php?option=com_content&task=view&id=42&Itemid=45).

<sup>142</sup> Energy companies are already strategizing informally about how to manage resistance to geosequestration, and a new term, ‘NUMBY syndrome’ – ‘Not Under My Back Yard’ – has recently been coined.

<sup>143</sup> Jeffrey Ball, ‘French Firm Cashes In Under UN Warming Program’, *Wall Street Journal*, 23 July 2008.

<sup>144</sup> Michael Wara, ‘Is the Global Carbon Market Working?’, *Nature*, Vol. 445 (2007), pp. 595–596.

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- <sup>145</sup> Guy Turner, New Carbon Finance, speaking at a European Commission meeting in June 2007.
- <sup>146</sup> United Nations Environment Programme, CDM Pipeline.
- <sup>147</sup> Lohmann, *Carbon Trading*, p. 147.
- <sup>148</sup> Ursula Schäfer-Preuss, Speech, Asian Development Bank, 2008, <http://www.adb.org/Documents/Speeches/2008/ms2008014.asp>.
- <sup>149</sup> ‘Indians Make Cool £300m in Carbon Farce’, *Sunday Times* (London), 22 April 2007.
- <sup>150</sup> Lohmann, *Carbon Trading*, p. 115.
- <sup>151</sup> Jeffrey Ball, ‘Pollution Credits Let Dumps Double Dip: Landfills Find New Revenue in Trading System Meant to Curb Greenhouse Emissions’, *Wall Street Journal*, 20 October 2008.
- <sup>152</sup> Lohmann, *Carbon Trading*, pp. 272-280.
- <sup>153</sup> Anonymous, personal communication.
- <sup>154</sup> Ben Fine, ‘Looking at the Crisis’.
- <sup>155</sup> Carolyn Fischer, ‘Project-Based Mechanisms for Emissions Reductions: Balancing Trade-Offs with Baselines’, *Energy Policy*, Vol. 33, No. 14 (2005), pp. 1807–1823, p. 1807. See also Haya, *Failed Mechanism*, p. 9; Lohmann, *Carbon Trading*, pp. 145-152; Lohmann, ‘Toward a Different Debate’.
- <sup>156</sup> Dan Welch, ‘A Buyer’s Guide to Offsets’, *Ethical Consumer*, No. 106 (2007).
- <sup>157</sup> Lambert Schneider, presentation at conference on Review of the EU ETS, Brussels, 15 June 2007.
- <sup>158</sup> *Financial Times*, 16 February 2005.
- <sup>159</sup> Larry Lohmann, ‘Democracy or Carbocracy? Intellectual Corruption and the Future of the Climate Debate’, Corner House Briefing Paper No. 24, October 2001, pp. 36-45. At first, forestry specialists imagined that they could measure precisely the amount of carbon a plantation project, say, was fixing, and therefore, the volume of pollution rights it could generate, simply by doing periodic measurements of tree growth, gas transfer in the canopy, and so forth. But it quickly became clear that quantifying the climatic impact of such projects would also necessitate investigating their effect on soils’ carbon production both inside plantation boundaries and downstream, requiring the hiring of additional experts. At the same time, sobering evidence emerged that error bars in such relatively simple matters as forest inventories and physical fluxes of carbon into and out of forests were so wide that they swamped the signal required for the establishment of a biotic carbon market. Unknowns concerning the response of soil biology and chemistry to global warming itself also became a significant consideration. Moreover, in order to complete their calculations, accountants realized, they would have to monitor the effects of plantations on the human groups displaced or otherwise affected. For example, communities evicted by carbon plantations might clear forests elsewhere, migrate to cities where they might adopt lifestyles with a different carbon budget, and so on. Due to the persistence of greenhouse gases in the atmosphere, the activities of such groups would have to be monitored over a significant time period (between 42 and 150 years) whose length itself was a contested issue. In formulating a counterfactual baseline for carbon production without the project, accountants would also have to venture into economic predictions about trade patterns involving commodities produced on forest lands, such as soy, as well as predictions about future currency exchange rates. Not surprisingly, as such difficulties mounted, the very concept of ‘project boundary’ became increasingly disputed within the community of sequestration experts – and with it the concepts of ‘carbon offset project’ itself and the status of the experts who attempted to frame it.
- <sup>160</sup> Achim Brunnengräber, ‘The Political Economy of the Kyoto Protocol’, *Socialist Register 2007*, pp. 224-25.
- <sup>161</sup> All regulation currently proposed for carbon markets assumes without evidence that this the distinction between fraud and non-fraud can be made and enforced. Under the Kyoto Protocol, this assumption forms the basis of the work of the Clean Development Mechanism Executive Board. In the US, it is the unexamined assumption of, for example, the Emissions Allowance Market Transparency Act (S. 2423) proposed by Senator Dianne Feinstein, the

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Investing in Climate Action and Protection Act (H.R. 6186), sponsored by Congressman Ed Markey and the Climate Market Auction Trust and Trade Emissions Reduction System (HR 6316) introduced by Congressman Lloyd Doggett.

<sup>162</sup> Haya, *Failed Mechanism*.

<sup>163</sup> Channel 4 (UK), 'Dispatches: The Great Carbon Smokescreen', 2007.

<sup>164</sup> Ibid. See also Central and Eastern Europe Bankwatch (CEE), *An*

*Analysis of Additionality: The Prototype Carbon Fund's Joint Implementation Project in the Czech Republic: Sixteen Small Hydropower Plants* (CEE, 2005); O. P. R. Van Vliet, A. P. C. Faaij & C. Dieperink, 'Forestry Projects under the Clean Development Mechanism', *Climatic Change*, Vol. 61, Nos. 1–2 (2003), pp. 123–156, p 154.

<sup>165</sup> Tom Young, 'UN suspends top CDM project verifier over lax audit allegations', *Business Green*, 1 December 2008.

<sup>166</sup> Michael Grubb, P. Vrolijk et al., *The Kyoto Protocol: A Guide and Assessment* (Royal Institute for International Affairs, 1999), p. 138.

<sup>167</sup> Haya, *Failed Mechanism*.

<sup>168</sup> Jeffrey Ball, 'Up In Smoke: Two Carbon-Market Millionaires Take a Hit as UN Clamps Down – EcoSecurities Sees Shares Slide 70 Per Cent', *Wall Street Journal*, 14 April 2008.

<sup>169</sup> FASE et al., 'Open Letter to Executives and Investors in the Prototype Carbon Fund' Espirito Santo, Brazil, 23 May 2003.

<sup>170</sup> A. P. L. Suptitz et al., 'Open Letter to the Clean Development Mechanism Executive Board', Minas Gerais, Brazil, 7 June 2004. Recent moves by the World Bank and other UN agencies to open up native forests to carbon accounting are similarly viewed as providing an opening for governments to threaten to destroy their forests if they are not granted carbon credits. See, e.g., *World Rainforest Movement Bulletin*, December 2008.

<sup>171</sup> Gilbertson, 'The Offsets Market in India'.

<sup>172</sup> Axel Michaelowa & Katharina Michaelowa, 'Does Climate Policy Promote Development?', *Climatic Change*, Vol. 84 (2007), pp. 1–4, p. 4.

<sup>173</sup> Wara, 'Is the Global Carbon Market Working?'.

<sup>174</sup> In August 2007, the CDM Executive Board published forms for the submission of applications for a new type of carbon project called programmatic CDM or 'programmes of activities' (PoA). A PoA, it stated, could be additional and thus acceptable as CDM even if a law already existed that mandated the measures that the PoA would bring about, if that law was not being 'enforced as envisaged but rather depend[ed] on the CDM to enforce it', or if the PoA would 'lead to a greater level of enforcement of the existing mandatory policy/regulation than would otherwise be the case' (Christina Figueres, 'The CDM and Sustainable Development', *Environmental Finance*, December 2007, pp. S50–S51). Oil companies have also applied for carbon credits for not flaring natural gas in Nigeria, a prohibition already mandated by the environmental laws of that country. Just as norms of commons regimes have historically been partly supplanted in many places by prices, so too now are legal safeguards (Lohmann, *Carbon Trading*, p. 148).

<sup>175</sup> Chris Leeds, 'Carbon Markets and Carbon Trading: Greener and More Profitable', presentation, 13 June 2008.

<sup>176</sup> 'CDM Market in Good Shape: Official', *Point Carbon*, 2 April 2008.

<sup>177</sup> Ball, 'Up In Smoke'.

<sup>178</sup> Redman, *World Bank: Climate Profiteer*.

<sup>179</sup> Fiona Harvey, 'Carbon credit ratings agency is launched', *Financial Times*, 25 June 2008.

<sup>180</sup> 'Carbon Finance 2008', *Environmental Finance* Conference, 8-9 October 2008.

<sup>181</sup> Marcel Braun, 'The Evolution of Emissions Trading in the European Union – the Role of Policy Networks, Knowledge and Policy Entrepreneurs', forthcoming in *Accounting, Organizations and Society*.

<sup>182</sup> 'Carbon Finance 2008', *Environmental Finance* Conference, 8-9 October 2008.

<sup>183</sup> S. Nicholls, 'Interview with Hans-Juergen Stehr', *Environmental Finance*, December 2007, p. S42.

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<sup>184</sup> Stien Reklef, ‘Cowboys or Cavalry?’, *Trading Carbon*, December 2007, pp. 27–28. Similarly, the International Emissions Trading Association has argued in a letter to US Senators Dianne Feinstein and Olympia Snowe, who had introduced a carbon market governance bill, that ‘[t]he market itself recognizes the importance of integrity and exerts discipline on participants ... Trading companies set their own trading limits to guard against excessive speculation. The market itself punishes firms that exceed responsible limits by downgrading credit ratings, lowering lines of credit or barring individuals or firms from trading’ (IETA letter to Sens. Feinstein and Snowe, 4 March 2008, <http://www.ieta.org/ieta/www/pages/getfile.php?docID=2938>).

<sup>185</sup> Madeleine M. L. Tan & Ronald S. Borod, ‘Why Limit the Asset Class?’, *International Securitization & Finance Report*, Vol. 10, No. 16 (2007), [http://www.brownrudnick.com/nr/pdf/articles/REPRINT\\_International\\_Securitization\\_and\\_Structured\\_Finance\\_Report\\_Why\\_Limit\\_the\\_Asset\\_Class\\_-\\_Energy\\_Tan\\_907.pdf](http://www.brownrudnick.com/nr/pdf/articles/REPRINT_International_Securitization_and_Structured_Finance_Report_Why_Limit_the_Asset_Class_-_Energy_Tan_907.pdf)

<sup>186</sup> Das, *Traders, Guns and Money*. This obscurity is deepened by the fact that the trend in the carbon markets is to conduct most trading over the counter rather than through exchanges. About 70 per cent of European Union Allowances, for example, are traded over the counter (Point Carbon, ‘Carbon 2008: Post 2012 is Now’, 11 March 2008).

<sup>187</sup> Lohmann, *Carbon Trading*, p. 196.

<sup>188</sup> ‘Debating Carbon’, *Trading Carbon*, October 2008, pp. 26-33, p. 28.

<sup>189</sup> Michael Specter, ‘Big Foot’, *New Yorker*, 25 February 2008; cf. Larry Lohmann, Carbon Trading, Climate Justice and the Production of Ignorance: Ten Examples’, *Development*, Vol. 51, No. 3, pp. 359–365.

<sup>190</sup> For an introduction to this literature, see, for example, James Fairhead & Melissa Leach, ‘False Forest History, Complicit Social Analysis: Rethinking some West African Environmental Narratives’, *World Development*, Vol. 23, No. 6 (1995), pp. 1023-35; Michael Dove, ‘Theories of Swidden Agriculture and the Political Economy of Ignorance’, *Agroforestry Systems* Vol. 1 (1983), pp. 95-103.

<sup>191</sup> Bookstaber, *Devil of Our Own Design*, p. 259.

<sup>192</sup> Stephen Gudeman, ‘Watching Wall Street’: In dealing with the financial crisis, the US government ‘has started by helping occupants at the top of the prestige and power scale (Wall Street or the financial realm) ... I think we should have a government plan to help economy’s base ... by providing debt relief to households ...’

<sup>193</sup> Axel Michaelowa, ‘Avoiding the Carbon Hangover’, *Carbon Trading*, December 2007, pp. 32–34; Fiona Harvey, ‘Beware the Carbon Offsetting Cowboys’, *Financial Times*, 26 April 2007.